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Tuan
Nguyen

TODAY'S DREAM IS TOMORROW'S REALITY

I WENT TO OCULUS CONNECT 3 this year for a peek at the future of high-performance graphics and VR. Michael Abrash, chief scientist at Oculus, gave a phenomenal presentation, and mentioned a quote from Billy Zelsnack that describes the case with this year's Dream Machine: "Pretty soon, computers will be fast."

When the *Maximum PC* team originally laid out the blueprints for Dream Machine 2016, we had a clear idea of what it should be: quad GPUs, an insane 10-core CPU, loads of RAM, and an awesome storage subsystem. Problem was, we knew that using last year's parts wouldn't fly—there were new GPUs, SSDs, and processors just beyond the horizon.

After waiting for two months, Nvidia announced its new Pascal GPU, with the GTX 1080 at the top of the stack. We had to have these GPUs, but they weren't going to be available as soon as we needed them. And that was just the beginning of our yearning for more power. We waited it out, and I'm glad we did. The new Pascal GPUs are monsters, and as Dream Machine is a monster in so many ways, using last-gen tech is a no-no.

Waiting for Pascal was the right decision—they're a clear upgrade from last year's four-way Maxwell Titan X rig in terms of gaming potential. Nvidia's 10-series GPU can also be coupled with a "10" of everything else that we had in mind for Dream Machine. Multiple 10-terabyte hard drives, 10-Gigabit Ethernet, and a 10-core processor. (Sorry, no 10TB Optane SSDs were available—maybe next year.)

Dream Machine always pushes the envelope in terms of performance and architecture. It's always an extreme example of what you can do with the PC. Being absurdly powerful—and expensive—we want Dream Machine to be able to handle anything you can throw at it. High-resolution 4K gaming, 3D rendering, 4K streaming and transcoding, and, of course, VR.

Humans have a cognitive ability to point to the future in a very cyclic direction. We have the most powerful components that we've ever seen in the PC scene this year, and it crushes all the benchmarks. But not too long from now—basically, a year—we'll be looking for even more power. Because as insane as Dream Machine 2016 is, there's always more—such as Sharp's recently demonstrated 8K 120Hz IGZO display.

What it comes down to is you as a PC user. As enthusiasts, we'll always chase the latest and greatest, but what will we do with all that power once we have it? For me, I'll be playing games. If I really want to push the envelope, *Deus Ex: Mankind Divided* at 4K Ultra + 4xMSAA can make even DM16 choke. Funny enough, the game I play the most is *Ori and the Blind Forest*—not exactly the most demanding game. But one day, when computers are fast, everyone will realize that playing at 500fps is the only way to play.

Tuan Nguyen is Maximum PC*'s editor-in-chief, also known as "the pointy end of the stick." He's been writing, marketing, and raising hell in the tech industry for 19 years.*

↘ submit your questions to: comments@maximumpc.com

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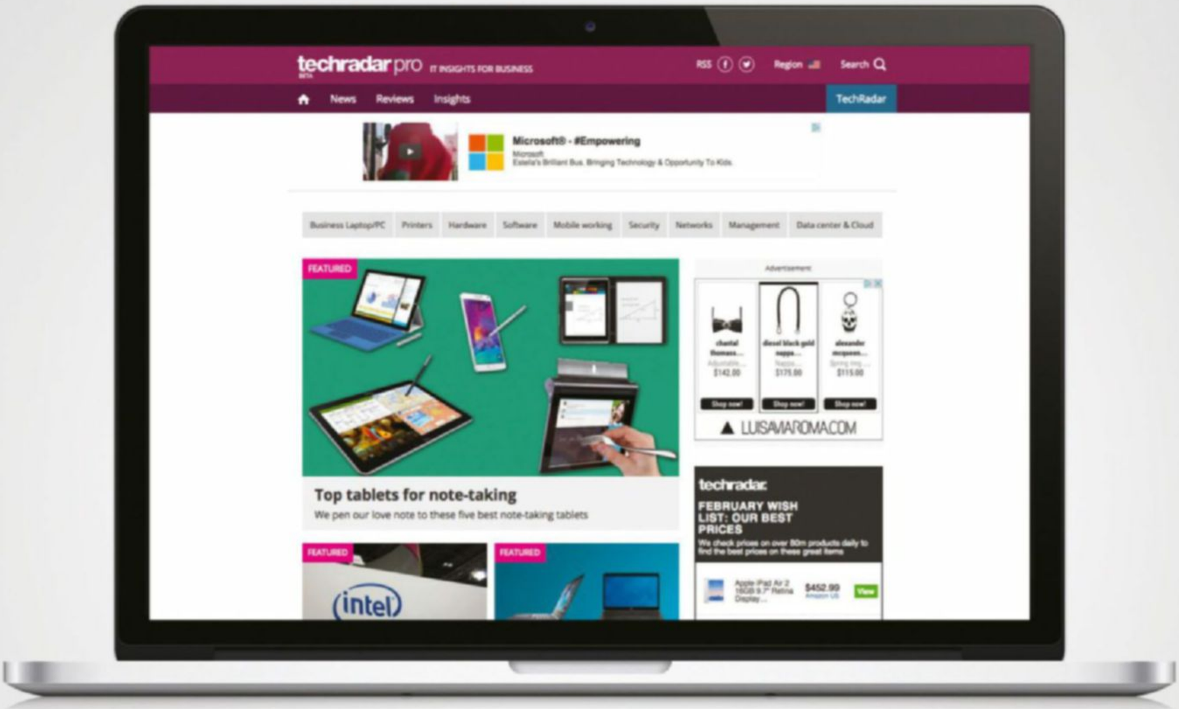
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THE NEWS

Google Brings Out the Hardware

Pixel phone gets Google Assistant, and sets its sights on Apple's iPhone

WHY THE BIG FUSS over Google's new Pixel phone? Because, unlike the Nexus series, it is more than a branding exercise. Google has integrated its own software into the Android 7.1 phone much more fully, including adding Google Assistant for the first time. The ultimate aim is to build an integrated suite of devices, a digital ecosystem, that offers a unified experience. This approach is what has made Apple so effective, and what puts the Pixel in direct competition with the iPhone.

There are two models. The Pixel has a five-inch 1920x1080 screen, a 2.1GHz Snapdragon 821 processor, coupled to 4GB of memory, and either 32GB or 128GB of storage. There's "the highest-rated smartphone camera ever," with 12.3MP, and a DxOMark of 89 (DxO Labs' benchmarking tool for digital cameras). The Pixel XL is the same, but a little bigger, with a six-inch 2560x1440 screen, and a higher capacity battery. The Pixel does have a 3.5mm jack, but isn't water-resistant, which has drawn some deserved criticism. It is also the first phone to be compatible with Google's VR platform, DayDream. The phone is being built by HTC, a welcome boost for the company, which has been struggling recently. Prices range from $649 to $869, exactly iPhone 7 territory.

The Google Home smart speaker can do far more than just play your music for you.

The Pixel isn't alone—at its big launch event, Google had a few other goodies to show off. These included Google Home, a so-called smart speaker. It looks like a large air freshener, but acts as a voice-activated portal to music services and libraries, similar to Amazon's Echo. It has few other tricks, too, depending on how wired your home is, including controlling video streaming via the Google Cast protocol. It'll set you back $129. To make sure you can run it anywhere, the company also has a new Wi-Fi router. And, lastly, we have the $79 DayDream View VR headset, so you can comfortably strap the Pixel to your head.

However, the next big step has yet to emerge—the much anticipated Andromeda project. This is a merging of Android and Chrome OS. It has been a long time coming, but the ambition warrants it—a single OS usable across a slew of platforms, from smart devices and phones through to laptops. Expect more next year, along with new Pixel laptops.

Google Assistant is Google's take on an AI-powered personal digital assistant. According to Google, it is "conversational, an ongoing two-way dialog between you and Google that understands your world and helps you get things done." It can tap into the vast well of knowledge Google has built for itself over the years, and if you've logged in at all, it'll have a fat file on your preferences.

Google's Pixel phone has decent specs, but the focus is the exclusive Google Assistant.

> “The aim is to build a digital ecosystem that offers a unified experience.

Google's previous hardware efforts have had a scattergun approach—Google Glass went nowhere. The Pixel and Google Home are properly integrated parts of a larger whole. The hardware is less important than the platform. Google wants to be with you wherever you are, and whatever you are doing. Competition is moving toward a time when the real focus is not so much about which hardware you are running, but on whether your digital world is powered by Google Assistant, Alexa, Cortana, or Siri. **–CL**

PLAYSTATION GOES VR

Is it time to get excited about VR all over again?

VR HAS BEEN BILLED as the next big thing for so long, that it's hard to get excited about the latest release. However, PlayStation VR could be the tipping point. The basic bundle costs $399, and is just a headset and cables. The $499 Launch Bundles add a PlayStation Camera, two Move Motion Controllers, and a copy of *VR Worlds*. You'll need the camera to run VR, and the controllers to make proper use of it. Add a PS4 and a DualShock 4 controller, and you're away. It runs at 920x1080, at either 90 or 120Hz, depending on the game. Latency is an adequate 18ms. Plus, other players can join in, using a regular controller on the main screen.

It's easy to set up, comfortable, and delivers a pretty decent VR experience. Support should run to 50 games by the end of the year, including examples from franchises such as *Batman*, *Resident Evil*, *Star Wars*, *Call of Duty*, and *Star Trek*. Downsides? You look like a demented Cylon. More practically, the motion tracking is occasionally imperfect, due to the single camera. You can't run around the room, or it loses track. There are also issues with light bleeding into the headset. It's not cheap, but compared to a high-end PC rig, it's affordable, and offers a true VR experience, compared to strapping a phone to your head.

What VR needs is some top titles. And that means volume sales. PC kit such as Oculus Rift and HTC Vive may have the edge in terms of performance, but haven't generated the big-number sales. If PlayStation VR can break into the mass-market, we will see serious game development budgets funneled into VR games, which will benefit everybody. **–CL**

YAHOO SQUEALS!

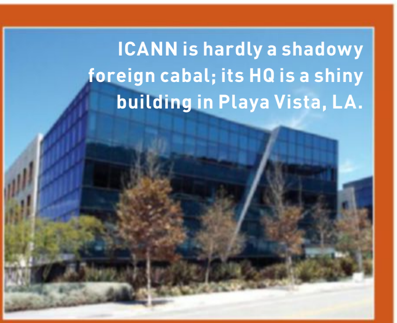
YAHOO HAS BEEN READING YOUR EMAILS ON BEHALF OF THE GOVERNMENT

IT HAS EMERGED that Yahoo, at the request of the National Security Agency and the FBI, has scanned emails for specific sets of characters. The "secret" project started last year, and has already scanned hundreds of millions of emails, although there's no news on whether anything has actually been handed over. There has been little from Yahoo on the subject, apart from the bland response that "Yahoo is a law-abiding company and complies with the laws of the United States." The NSA was equally tight-lipped—it does not comment on "specific techniques."

The scanning is unusual because of its all-encompassing nature. Previously, efforts concentrated on specific suspects. The Electronic Frontier Foundation claims it "flies in the face of the Fourth Amendment's prohibition against unreasonable searches." Senator Ron Wyden, a frequent critic of government surveillance, said: "Federal law is being interpreted in ways that many Americans would find surprising and troubling." Quite. **–CL**

AMERICA GIVES AWAY INTERNET

Global addressing goes international



ICANN is hardly a shadowy foreign cabal; its HQ is a shiny building in Playa Vista, LA.

PRACTICALLY THE LAST BIT of the Internet under US control has been handed over to an international body. The Internet Assigned Number Authority, IANA, looks after global-level IP addresses and domain names. It was run under contract by a non-profit private US corporation. That contract has expired, and it is to be moved to a group under the auspices of ICANN, the Internet Corporation for Assigned Names and Numbers, the body that looks after just about everything else to do with Internet addressing protocols.

The move has drawn heated rhetoric, and been used as a stick to beat Obama. Fears have been raised about possible censorship, and government surveillance by overseas powers. Oddly, it was these arguments that prompted the desire to move all aspects of Internet protocols to international bodies to start with. **–CL**

Tech Tragedies and Triumphs

A monthly snapshot of what's up and down in tech

TRIUMPHS

+ **SUPER SMALL AND CUTE**
Say "ahhh" to Kirobo, a four-inch, $400 robot companion from Toyota. The loveable tyke can interact through voice, gestures, and movement.

+ **DISEASE DONATION**
Mark Zuckerberg and his wife Priscilla Chan are to donate $3 billion to help rid the world of disease.

+ **MARTY MCFLY KICKS**
Nike has built Mags trainers that mimic those in *Back to the Future II*, including those powered laces. They are only available via a charity raffle.

TRAGEDIES

– **GALAXY NOTE 7 WOES DEEPEN**
Samsung's problems with its Galaxy Note 7 haven't been fixed by a recall. Reports are emerging of the replacements also suffering fires.

– **BILLBOARD HACKER ARRESTED**
An IT analyst in Indonesia faces up to six years in prison after hacking into an electronic roadside billboard, and showing a porn film on it.

– **YAHOO IN MORE TROUBLE**
After agreeing the sale to Verizon, Yahoo is being asked for a discount of $1 billion on the $4.83 billion price.

Jarred Walton

TECH TALK

How the Race for 7nm Will Be Won

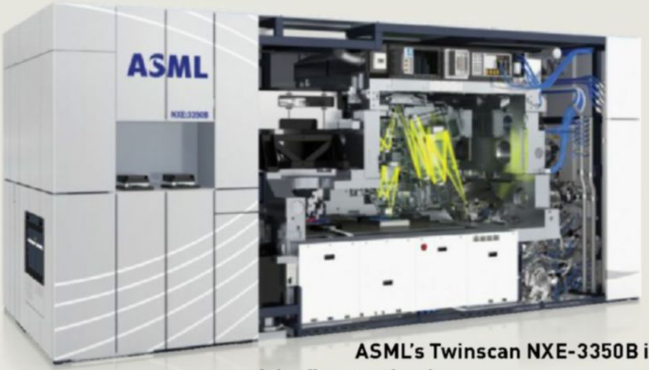
PROGRESS IN THE WORLD of semiconductor manufacturing typically follows a pattern of steady improvements. Intel has been averaging around a 30 percent shrink in feature size each generation, going all the way back to the 1.5 micron chips of the early '80s. Other companies have followed a similar pattern.

GlobalFoundries (formerly AMD's fabrication group) is looking to change that with its next process node. It formally announced its intent to skip 10nm, focusing instead on getting 7nm ready. Getting to 7nm is a story in itself, as feature size becomes so small that light wavelength is an increasingly big hurdle.

Current 22nm to 14nm process nodes use multiple patterning lithography to create the tiny transistors at the heart of processors. In essence, all the features can't be done in a single pass, so some are done in the first pass, and the others in a second pass (or in three or four passes). This is done via immersion lithography using 193nm wavelength deep ultraviolet (DUV) light, but advances in extreme ultraviolet (EUV) light, with a 13.5nm wavelength, could allow a single pass in place of multiple ones—plus, EUV paves the way to 5nm and beyond.

The problem is that EUV requires lasers with significantly higher intensities, and that means more power. GloFo plans to stick with DUV with triple or quadruple patterning for its initial 7nm rollout, bypassing the EUV difficulties for now. It plans to have full specifications in 2017, production slated for 2018, and first retail products by 2019. If GloFo can execute on its plans, it'll be close to parity with its main competition—Intel, Samsung, and TSMC.

Triple/quadruple patterning presents its own challenges, but most companies appear to prefer multiple-patterning over EUV for the next step. Samsung has talked about partial use of EUV at 7nm, while TSMC is planning on 5nm EUV in 2020. Intel hasn't officially stated when it intends to begin using EUV, though its 10nm and 7nm processes will proceed without EUV. Like Samsung, GloFo is talking about 7nm EUV, but in GloFo's case, it will be a separate process node—a second generation of 7nm. It has yet to release specifications for either node, however, and the use of EUV hinges largely on another company: ASML.



ASML's Twinscan NXE-3350B is one of the first production systems to support EUV.

ASML is the supplier of most of the world's leading-edge photolithography equipment, and it's working to get its EUV Twinscan NXE available in sufficient quantities/availability. Depending on when that happens, GloFo's 7nm DUV node might be short-lived. Either way, if GloFo can execute on its 7nm roadmap, its partners—specifically AMD—stand to be in a good position to reap the benefits in 2018/19. Skipping over a delayed 10nm should help GloFo and AMD stay competitive, and if EUV is ready sooner rather than later, plans are in place to integrate the technology.

Note that, in all this talk of feature sizes, things aren't always directly comparable. TSMC's 16nm FinFET is reportedly quite close to Samsung's 14nm FinFET in characteristics, and Intel claims its 10nm FinFET will offer similar transistor densities to other companies' 7nm FinFET. What's important is progress within a company.

So, the race is on, both to create a large-scale deployment of EUV and to get down to single nanometer digits for process technology. Moore's Law may not be a law, but as a goal the tech industry can strive toward, its ghost lives on. EUV should see us through many more years of progress, eventually allowing us to move into the sub-nanometer world of process tech.

Jarred Walton has been a PC and gaming enthusiast for over 30 years.

THE LIST

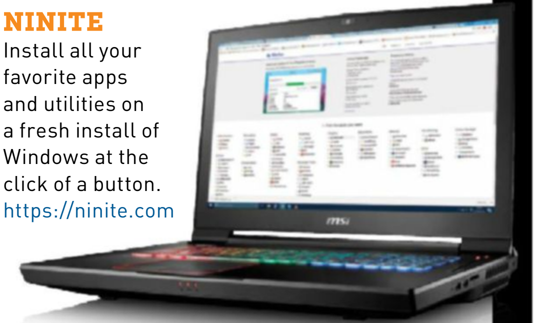
8 UTILITIES TO INSTALL ON WINDOWS 10

8 VLC

The movie and audio player that deserves to be on every machine. It just does it all.
www.videolan.org

7 NINITE

Install all your favorite apps and utilities on a fresh install of Windows at the click of a button.
https://ninite.com



6 MALWAREBYTES ANTI-MALWARE FREE

Whatever antivirus you use, it's worth having this to hand as well. You know, just in case.
www.malwarebytes.com

5 TREESIZE FREE

Find out which programs are eating up your storage with this great tool.
www.jam-software.com

4 PAINT.NET

Forget MS Paint—if you're looking to do anything with images, you should install this instead.
www.getpaint.net

3 NOTEPAD++

All the convenience and versatility of Notepad, but with more features for tinkerers and programmers.
https://notepad-plus-plus.org

2 7-ZIP

When Windows falters, 7-Zip has your back, covering more compression algorithms than you could shake a stick at.
www.7-zip.org

1 F.LUX

F.lux adapts the color of your screen to the time of day, potentially improving your sleep patterns while it's at it.
http://justgetflux.com

Alex Campbell

OPEN SOURCE

Give the Gift of Learning this Holiday Season

WHEN I WAS A KID, all I usually wanted for Christmas was the latest, greatest Lego kit. Sure, the kits were certainly fun to build the first time you opened them up, but what I really wanted from them were the parts.

Exotic pieces with varying shapes and colors only came in certain kits, and I could always find a use for them. Lego was (and still is) an awesome toy, because it provides a medium for problem-solving, three-dimensional thinking, and creativity. However, if I were a kid today, there's a good chance I'd be putting a Raspberry Pi or Arduino on my Christmas wish list instead.

A Raspberry Pi can exercise many of those same brain muscles with the right project. However, there's an additional skill that is taught: computing. While I consider myself a digital native, it's largely because I took on computers as a hobby when I was young. I came of age in the time of Napster and AOL, which meant that playing games with friends or logging on to an IRC server required some degree of technical skill. Nowadays, children play with iPads that are more powerful than the 386 I once had in my bedroom. But there's something missing here in the shiny, gadgetry of retail electronics; there's no "aha!" moment of discovery when you finally work through a problem.

If there's one thing that I've gained from free and open-source software, it has been the opportunity to learn how the software on my computer works. Whether it's learning how to manipulate the USB ports or GPIO pins on the Raspberry Pi using Python, or installing Arch Linux to create very my own customized Linux installation, open source has provided me with an amazing array of hands-on learning experiences. It's not much different from that feeling I got from playing with Lego.

> Nowadays, children play with iPads that are more powerful than the 386 I once had in my bedroom.

In the spirit of giving, consider dropping $35 on a Raspberry Pi for your kid niece or nephew. It's small enough to be a stocking stuffer, and yet it has the potential to inspire a young mind. If you're a little more cash-strapped this season, you could always hand out a copy of your favorite Linux distribution for the cost of a USB drive. (You can find 4GB USB 2.0 drives for under $5 nowadays.) You could even decorate the USB sticks, and make them a little more festive.

The holidays are also a popular time to give to charities and non-profits. It's the season of giving, and it's also the end of the tax year. While nearly any project you can think of would graciously accept and make use of even small donations, it should be noted that only a few free and open-source software organizations (such as Mozilla and GNOME foundations) enjoy 501(c)(3) status from the IRS. If you choose to do any of these things, you can give the gift of software freedom in a way that will make Ol' Saint Stallman gleeful with joy. (Well, so long as you say "GNU slash Linux.")

The Raspberry Pi 3 model B is a cheap computer for projects and learning about computing.

Freedom arguments aside, giving away tools to create useful, interesting, and fun things is what the free software movement is really all about. After all, free software is a real-world example of the expression, "'Tis better to give than to receive." I think many can agree the world needs more of that.

Alex Campbell is a Linux geek who enjoys learning about computer security.

CREATIVE COMMONS PHOTO: WIKIMEDIA COMMONS

TALKING

BY **ZAK STOREY**

SteelSeries Unveils a New Design Ethos: the Arctis

Maximum PC probes SteelSeries's design process

Peripherals and gaming audio: they're a crucial part of a multi-billion-dollar industry. Thousands of hours and huge levels of investment go into designing headsets that are worn across the globe. We spoke to Brian Fallon, audio guru and headset developer at SteelSeries, to see what thought processes go into designing headsets, how they develop the latest and greatest, and how important driver design is in calibrating the perfect model.

Brian Fallon has a history of working in audio almost as long as *Maximum PC* has been in print.

Maximum PC: Where do you start when designing a new headset? What considerations do you have to make?

Brian Fallon: Just like designing any product, it's important to understand who your customer is. Who are you designing this for? And that's where we took a step back with Arctis. We've been making headsets and gaming products at SteelSeries for a long time, and over the course of that time, who gamers are has changed—the reach of gaming has broadened; there are more people who you would consider gamers. It used to be that maybe only the more hardcore gamers would go out and get dedicated peripherals, but now so many people who are into gaming are really interested in getting some higher quality equipment that will enhance their gaming. They've spent money on a console or a PC, and they want other peripherals that are going to help enhance that experience. So, for us, it was about taking a step back, and breaking down some of the stereotypes of who these gamers are, and thinking about them in terms of the modern gamer, who is a very diverse type of person. So, we wanted to design these Arctis headsets with that in mind, and not go with what you'd stereotypically think of as a gaming headset, which has become a bulky, toy-like design. We wanted to make something that was a serious piece of audio equipment, that was going to look great, and give better performance than you'd expect out of most gaming devices.

MPC: What ergonomic decisions do you have to make when designing a headset like the Arctis?

BF: As we've been making headsets for a long time, we had a lot of our own research and legacy knowledge that we've gained. But the main ergonomic considerations are on the comfort side: figuring out how to come up with a design that is going to be able to fit all different sizes and shapes of heads. When you actually look at data of how people's head sizes vary, it's pretty huge, so coming up with a design that will work for everyone—and not only just fit everyone, but fit comfortably—is a big challenge. So, we go through a lot of different iterations on design. Once we've dialed in what kinda style and shape we want, then it's coming up with the exact right dimensions, the right curves of things that are going to fit everybody best, getting the right amount of pressure around the ears, and distributing the weight nicely around the headset, so it feels really light.

MPC: Can you tell us SteelSeries's thoughts on frequency response, and what makes a good driver?

BF: I put a lot of weight on headphone frequency response, and we did a lot of work on the Arctis headsets to dial in exactly the type of sound that we wanted. We've been talking amongst ourselves about how the gaming headset industry has steered toward this. I'm calling it "The Bass Wars," where they just keep coming back and using the same terms, like "thundering lows" and "experience explosions,"

The new headband, designed around ski goggles, helps keep things comfortable.

and it's just been increasing amounts of bass. Frequency response is part of the equation, but distortion is a huge part of sound quality, too. As a lot of these headsets keep increasing the amount of bass, the amount of distortion is going up as well, so our take was to start with a very high quality speaker driver for the Arctis line—we actually went to our Siberia 800 series, our top-of-the line flagship headsets right now. We pulled that speaker driver from those headsets, because it's a really nice high-performing driver, with ultra low distortion, and we worked that into the new Arctis line. Then we did the tuning from there, to go after the response that we wanted, and my focus was to design something that would sound good, no matter what you played through it.

A lot of companies market to explosions and footsteps, but there are so many different types of games. Sure, in the first-person shooter realm, you might be listening for really distinct details that you want to pick out in space, and that's really important, but there's also the huge MMO-type games, and really immersive cinematic action games, and simulation games. There's all kinds of different soundscapes out there, so my mantra has been that good audio is good audio, and if you create something that sounds good, no matter what you put through it, it's going to sound great.

> I invite even naysayers of surround sound to give DTS Headphone X a try—it definitely enhances gameplay.

MPC: What are your thoughts on virtual surround? What is SteelSeries doing to make it a more enjoyable experience for a wider variety of people?

BF: All the products have a version of 7.1 surround—it's a really important feature—and, sure, there are some people who don't believe in that as a technology or something that they want to use. But, in all the research that we're doing, there are far more people for whom that is a really important feature of their gaming. That said, we didn't just want to deliver any surround solution, because there are several out there on the market, and we tested everything to find what we thought was best. So, what's interesting with Arctis, is that even starting on the Arctis 3, which is an analog wired headset, it still comes with 7.1 surround. It's done in software, via our SteelSeries Engine, and that one comes with our SteelSeries 7.1 solution. It's kind of a basic way to get started with 7.1, and it works extremely well to give you good positional audio. Now, stepping up to the Arctis 5 and the Arctis 7 headsets, those come with DTS Headphone X, which is a premium surround solution. The reason is, in order to use DTS, you have to send in your headsets to DTS, who does a series of acoustic measurements on them. DTS then takes that information and bakes it into the algorithm, and returns a custom-tuned version of Headphone X to you *[the manufacturer]*, specifically for your headset. So, that gives you a really dialed-in ability to have super-accurate positioning in the 3D space, which is why we see that as a premium solution.

I invite even those naysayers of surround sound to give DTS Headphone X a try with some of the more modern games, which have worked a lot of surround content into the way that they mix their audio, and see what the experience is like, because it's pretty unique, and it definitely enhances the gameplay.

MPC: Can you talk to us a little about how you're innovating in the microphone market? We've heard rumors of the Arctis running a bidirectional, as opposed to omnidirectional, mic.

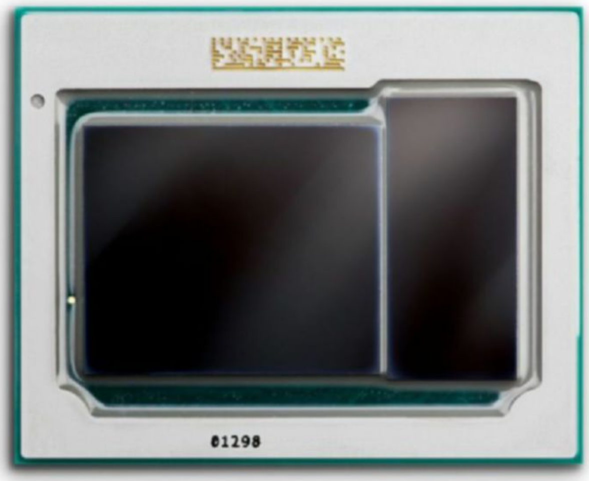
BF: Yeah, so the microphone is probably one of the areas that I'm most excited about with Arctis. I think it's really going to change the expectations gamers have when they buy a headset. I mean, everything I've read, from tech reviews to user reviews about gaming headsets—ours included—the nicest thing I've ever read was, "The microphone worked fine." There's never been anyone saying, "Oh yeah, my voice sounded great with this." The bar is set so low, and we've kinda questioned, why is that? Why does it have to be that way? So, we pinpointed really early in our Arctis development that it was an area where we wanted to try to improve.

To that end, we contracted with a third-party acoustic consultant firm, and gave it our headsets and our competitors' headsets, and we had the firm put the microphones through a whole series of different acoustic evaluations. Kinda unsurprisingly, they came back mediocre at best, and one of the areas where they really fell flat was in their ability to cancel out background noise. So, you can have a great-sounding microphone, where your voice sounds good, but if it lets in too much of what's going on in the room around you, it doesn't really matter, because that's going to muddy up your speech. So, our switch to a bidirectional mic was expressly to try to limit the amount of background noise that gets in. A unidirectional mic picks up from the front and rejects from the back, but it also lets in a fair amount of sound from the sides. Whereas a bidirectional mic does pick up from the front and the back, but it does so in a really narrow pattern, so if you have this mic right in front of your face, it has a good amount of proximity effect, so you can get that nice boost to the lows. Basically, you get a kinda natural boost to your overall voice, then everything from the sides gets pretty much rejected completely.

DOCTOR

THIS MONTH THE DOCTOR TACKLES...

> Beating Bottlenecks
> Kaby Lake Power
> Manic Multi-Tasking



Intel's Kaby Lake CPUs are architecturally similar to the Skylake models that preceded them.

Smashing Bottlenecks

Hey Doc, I'm currently running an extremely low-end setup and would love to upgrade. I have an Acer motherboard, an AMD A10-5500 processor, a Radeon HD 7350 graphics card, and two mechanical hard drives.

I have my sights set on an AMD A10-7850K and a Radeon RX 480. But where is my bottleneck? I am only going to upgrade one component at a time. Thanks for any advice.

–Trevor Giampieri

THE DOCTOR RESPONDS: The Doc assumes that you have an A8-5500 (the entry-level A10 model is a -5700). Either way, your Trinity-based APU uses AMD's Socket FM2 interface. Upgrading to an A10-7850K first requires buying a new motherboard with Socket FM2+. Your older CPU would still work in the new board, but you won't see much benefit aside from up-to-date I/O.

On the other hand, jumping from a low-end Radeon HD 7350 to the Radeon RX 480 could have a huge impact. Games stand to gain most, though the A8 becomes a much more probable bottleneck.

Here's something else to consider: AMD is shipping seventh-generation APUs (yours is second-gen) in HP and Lenovo PCs. Soon, it'll make those processors available to the do-it-yourself community. They drop into Socket AM4, use DDR4 memory, and are complemented by more modern chipsets. Pricing isn't available as of this writing, but there should be models in the same range as your A10-7850K target. The Doc prescribes a Radeon RX 480 now and a Socket AM4 upgrade later.

A Challenger Appears

Hi. The note you published from John Fertig gave me a chuckle. So, John thinks 78 is old? I'm 82 and have used PCs since 1985. I have two that I use simultaneously. I am a Windows Insider (currently using Windows 10 Pro, version 1607, build 14926), and last month I received a $100 gift certificate from Acronis for being one of their top 10 beta testers. Maybe someday I'll get "old" and have to slow down, but I ain't there yet. **–Jerry Bell**

THE DOCTOR RESPONDS: Do you mind if the Doc sends some of his Windows 10 questions your way, Jerry? There's a good chance you have more background with Microsoft's latest. Much respect, sir.

Pick an Upgrade...

Doc, like the reader in October's issue, I do not game. However, I needed a system with as much processing power as possible to move data around quickly. Specifically, I do a lot of bit-by-bit drive imaging. I wanted a fast storage subsystem, with ample capacity, and the ability to take advantage of multiple cores.

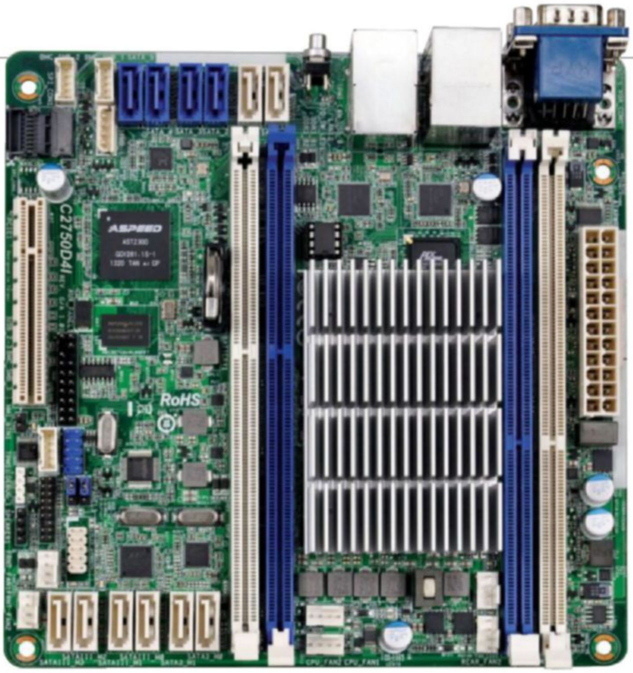
I've been reading *Maximum PC* for a long time, and I use it to evaluate components and build from that. After much research, I built my current machine with the following specs: Corsair Obsidian 750D full-tower case, Asus X99-E WS motherboard, Intel Core i7-5960X CPU, Zalman LQ-320 closed-loop CPU cooler, Asus GeForce GTX 950, Corsair Dominator Platinum 64GB DDR4-2400 memory kit, Cooler Master V1000 power supply, Intel 750 Series 1.2TB PCIe NVMe SSD (primary working drive), and a Western Digital Black 4TB hard drive (for data storage).

It works well, but based on what I described, is there one component you would suggest upgrading to further improve performance? **–CW in Georgia**

THE DOCTOR RESPONDS: Although there are higher-end components out there, you'd be hard-pressed to extract much

↘ submit your questions to: doctor@maximumpc.com additional value from them. The only stand-out is your GeForce card, and without an imminent need for graphics processing, a GTX 950 is presumably ample.

If you do a lot of work with storage, though, consider some form of redundancy. The Intel SSD and WD hard drive should last for years, but in the event of a failure, you wouldn't want to lose the user data on the mechanical disk. Add a second 4TB drive in RAID 1, three more in RAID 10, or consider a NAS device with support for iSCSI.



ASRock's C2750D4I motherboard hosts an eight-core Avoton CPU, along with 12 SATA ports for storage.

Kaby Lake and PSUs

Hello Doc. I'm planning a new build based on the upcoming Kaby Lake processor, and I'm buying parts in anticipation of the release. Looking at power supplies, some claim to be Skylake-ready, Broadwell-ready, and so on. Should I hold off on buying a new power supply until I start seeing Kaby Lake-ready units? **–Les W**

THE DOCTOR RESPONDS: Several generations ago, as Intel transitioned from its Ivy Bridge core design to Haswell, it introduced certain sleep states that helped reduce power consumption. PSUs built before this change weren't necessarily compatible. But, at worst, you'd simply disable the sleep states in your BIOS to avoid issues.

Broadwell- and Skylake-based CPUs carry those power features over. Kaby Lake should be no different. So, as long as the PSU you're looking at is Haswell-ready, there should be no reason to stress about interoperability with Kaby Lake.

Threaded Processing

Hi Doc, my question is about multicore/multithread processing. I usually have multiple instances of programs open. It's common for me to run Outlook, File Explorer, three to five Excel workbooks, two or three Visio drawings, one or two web browsers, Power PDF Advanced, and TurboCAD, all at the same time. I switch back and forth, cut and paste, insert photos and PDFs, all while running Norton Internet Security, Malwarebytes, Acronis True Image, print monitors for three printers, and whatever else Microsoft forces on me.

I know there is an advantage to wielding multiple cores when using photo and video editing software designed to take advantage of them, but I typically don't use those applications, and I can't find any solid information pertaining to the way I use my PC.

My main machine is a four-year-old Core i7-based laptop, and I'm ready to buy a new one with a 200-series chipset. What features should I put my money into in order to realize the best performance possible? Is there a reason for me to pursue more cores, more memory, or both? **–Steve Kaen**

THE DOCTOR RESPONDS: Multithreaded apps are used to benchmark CPUs because they use hardware resources thoroughly, and often in a way that is repeatable. However, a multi-tasking environment like the one you're describing also benefits from multiple cores.

Excel, Visio, and Outlook mostly sit idle waiting for your input, so you don't expect them to bring your CPU to its knees. But it's not hard to imagine a situation where a virus scan kicks off as you're typing an email, with Windows Media Player serving tunes in the background. That's more demanding. Factor in Windows' background processes and pro-level software like TurboCAD, and even high-end processors can get bogged down with sophisticated multi-tasking.

You mentioned you're using a laptop, though. The top mobile machines mostly use quad-core CPUs. You'll probably want one of those with at least 8GB of memory (16GB isn't uncommon). Here's one other suggestion: grab one or two monitors to go with your next notebook. Once upon a time, the Doc used four displays to maximize productivity. Now he gets by with three. But if you're switching between that many applications, keeping them all open on different screens could be an even bigger time-saver.

MSI Answers the Call

Doc, I just purchased an MSI WS72 6QI laptop. It runs great. But after updating Windows 10 Pro to version 1607 the keyboard backlighting no longer works properly—it only shuts off when the computer goes to sleep, not after a short period of inactivity. MSI instructed me to perform a system restore, but that didn't resolve the issue.

The laptop has a Steelcase keyboard. However, it appears that there is a Microsoft driver installed. Steelcase tells me I need to install its driver for the backlighting to work properly. Before I proceed further, I'd like to know your thoughts. **–Chris Hax**

THE DOCTOR RESPONDS: Lenny Tang of MSI's notebook team was kind enough to respond: "There have been some issues with Microsoft's Anniversary Update, as you have seen around the web. Microsoft released a quick patch, but is telling most users to hold off updating to this version. I recommend uninstalling the keyboard driver, then reinstalling the SteelSeries Engine 3 software from https://steelseries.com/engine."

Lenny's guidance is doubly advisable as SteelSeries updated its software twice since the Anniversary Update launched. There's a good chance those recent builds include relevant bug fixes.

Basic Server Parts

Hello Doc! The October 2016 issue has a fantastic article on building a home server. However, the article states that a dual-core CPU, 4GB of RAM, and a couple of 1TB hard drives are all you need. I could use some advice on a CPU and motherboard that'd serve my purpose. If the motherboard fit into a small chassis, that would be great. **–Gregg Germain**

THE DOCTOR RESPONDS: Streaming music and movies over a home network is fairly lightweight work, so the hardware side tends to take a back seat. Most older PCs are fast enough, and it's rarely necessary to spend much money at all.

If you really want to build something from scratch, ASRock sells a couple of four- and eight-core Atom-based Mini-ITX motherboards designed for storage applications (check out the C2550D4I and C2750D4I). They aren't cheap, but you get plenty of performance, standard DDR3 memory slots, and tons of SATA connectivity.

Windows 10

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DREAM MACHINE 2016

WHERE DO YOU START with the Dream Machine? It's a concept. A way of pushing limits. And, for as long as we remember, money hasn't been an issue when building a Dream Machine. Its legacy has, for the most part, been untarnished by cries of "It costs too much!" That said, this has been a traumatic year in the deepest, darkest circles of technology. And with Nvidia still unchallenged in the world of graphical dominance, the Titan's reign as the fastest GPU comes with an unfeasible price tag. We couldn't bring ourselves to be so bold as to invest in two Titans, when we could pick up four GTX 1080s for about the same price—not that Nvidia enables SLI beyond two....

So, is it still a Dream Machine? You tell us. There's over 40TB of hard drive storage, 128GB of RAM clocked at 2,666MT/s, 10 cores, 20 threads running at a blistering 4.2GHz, and two heavily overclocked GTX 1080s running at a phenomenal 2,126MHz. All of which is kept chilled via two handcrafted water-cooling loops. And we can't forget the trophy cabinet privileged with housing this magnificent list of hardware: In Win's 909. Comprised entirely of brushed aluminum, this beautifully sleek and versatile case is a true sight to behold.

Is this a PC for the gamer? No—it's a PC for the professional, a PC with limitless potential, a PC that can attempt whatever task you set it, and succeed with ease. **–MAXIMUM PC STAFF**

BUILD IT!
Step-by-step guide **PG. 70**

IN WIN
be quiet!
DARK POWER PRO
1200 WATT
ASUS

EXTREME HARDWARE

IF MONEY'S NO OBJECT, what would your Dream Machine look like? It's a question we consider a lot, not least because of our annual quest. Are they reasonable systems? Of course not. But that's not what it's about. We don't aim to ramp the price up, just piece together the best system we can. This year, we went for sleek, subtle, and clean. It's all about maximizing potential. So, without further ado, let's see what went into this monster rig.

INGREDIENTS

PART		PRICE
CPU	Intel Core i7-6950X	$1,650
Motherboard	Asus X99-E-10G WS	$650
RAM	128GB (8x 16GB) G.Skill Trident Z F4-3200	$770
GPUs	2x MSI GeForce GTX 1080 Gaming X 8G	$1,440
SSD	Intel 750 1.2TB U.2 PCIe	$821
HDDs	4x Hitachi He10 10TB	$3,000
PSU	Be Quiet! Dark Power Pro 11 Platinum 1,200W	$240
Case	In Win 909	$400
Fans	4x EK-Vardar F4-120ER (2,200rpm)	$73
Cooling	EKWB Custom Loop	$1,227
Monitor	Asus PA329Q 32-inch IPS 4K	$1,250
Mouse	SteelSeries Rival 700	$100
Keyboard	Corsair K70 LUX RGB Cherry MX Blue	$160
Headset	Audio-Technica ATH-AG1X	$300
Accessories	CableMod B-Series DPP Modflex Cable Kit	$100
OS	Windows 10 Pro	$140
Tools	Dremel 4000 Rotary Tool, Wagner Heatgun	$136
Total		**$12,457**

1 **GPUs** Two MSI GeForce GTX 1080s inhabit this year's Dream Machine. We know: no Titans. But, at twice the cost and less than a 20 percent performance increase, we couldn't justify it. So, we grabbed these, slapped on some waterblocks, and overclocked the hell out of them: 2,100MHz-plus, and 11GHz on memory.

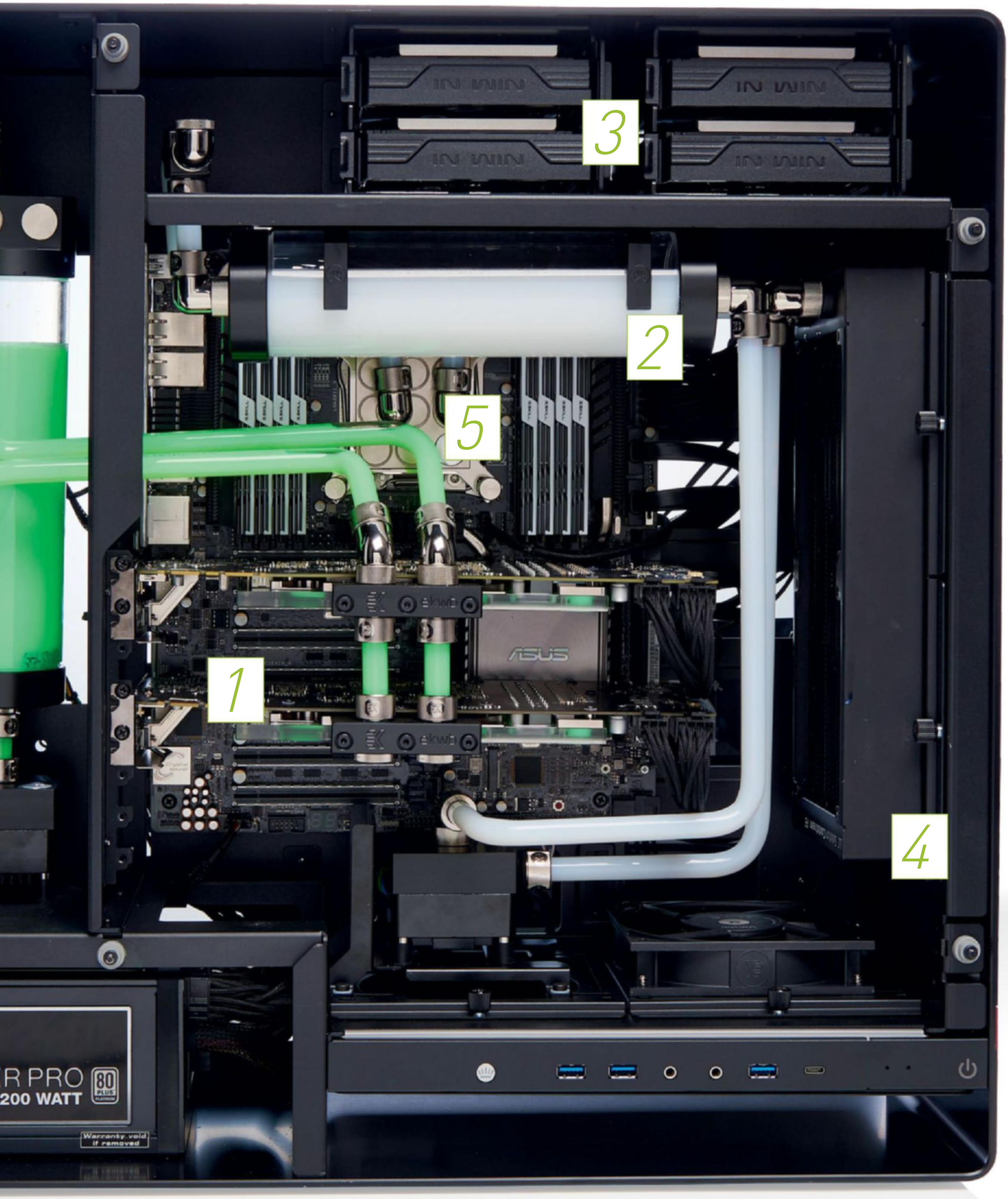
2 **WATER COOLING** We mixed it up a little and went for a dual loop. One for the GPUs, and one for the CPU. We even managed to passively cool the CPU without fans, and keep the overclock at 4.2GHz.

3 **STORAGE** The real showpiece is those four 10TB hard drives. We slapped all four of them into RAID 0 (yep), enabling sequential reads and writes up to 1GB/s—twice as fast as the best SATA SSDs.

4 **CASE** The In Win 909 is a real show-stopper. It's lean, mean, and constructed entirely from aluminum. There's nothing not to like about this highly versatile case.

5 **CPU** Who could forget that CPU? The Core i7-6950X is Intel's greatest consumer processor to date. Featuring 10 cores, 20 threads, and almost passively cooled by our funky setup, this monster cruises along at 4.2GHz, obliterating benchmarks left, right, and center. The only complication is how far your jaw drops when you see those rendering times.

2
be quiet!
DARK POWE
1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- 6th Generation Intel® Core™ i7-6700K Processor (8MB Smart Cache, 4.0GHz)
- Windows® 10 Home 64-bit Edition
- 17.3" 3K QHD, 120Hz 5ms Matte Display (2560x1440) with NVIDIA® G-SYNC Technology
- Dual 8GB DDR5 NVIDIA® GeForce™ GTX 1080 GPU with SLI™ Technology
- 16GB Dual Channel DDR4-2400MHz Memory
- 512GB SanDisk X400 M.2 SSD + 1TB 7200RPM Hard Drive
- 2 Hard Drives + 2 M.2 SATA SSD Drives or 2 M.2 PCIe SSD Drives capable
- Hardware Raid 0,1 Function capable
- Full sized Keyboard with color LED backlight
- Killer DoubleShot-X3™ Pro (2X Killer E2400 LAN + Killer Dual Band Wireless-AC 1535) with Smart Teaming
- USB 3.1 / Thunderbolt Gen3 Combo Port
- Built-in 2.0M FHD Camera & Fingerprint Reader
- Built-in speakers & a sub-woofer tuned by SoundBlaster
- Headphone output with ESS SABRE HIFI Audio DAC
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CORE™ i7
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- Windows® 10 Home 64-bit Edition
- 17.3" 3K QHD, 120Hz 5ms Matte Display (2560x1440) with NVIDIA® G-SYNC Technology
- 8GB DDR5 NVIDIA® GeForce™ GTX 1080 GPU
- 16GB Dual Channel DDR4-2400MHz Memory
- 256GB SanDisk X400 M.2 SSD + 1TB 7200RPM Hard Drive
- 2 Hard Drives + 2 M.2 SATA SSD Drives or 2 M.2 PCIe SSD Drives capable
- Hardware Raid 0,1 Function capable
- Full sized Keyboard with color LED backlight
- Killer™ DoubleShot™ Pro (2X Killer E2400 LAN + Killer Dual Band Wireless-AC 1535) with Smart Teaming
- USB 3.1 / Thunderbolt Gen3 Combo Port
- Built-in 2.0M FHD Camera & Fingerprint Reader
- Built-in speakers & a sub-woofer tuned by SoundBlaster
- Headphone output with ESS SABRE HIFI Audio DAC
- Sound Blaster® X-Fi™ MB5 Sound System

NP9172-S Notebook

$2,249

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- 6th Generation Intel® Core™ i7-6700K Processor (8MB Smart Cache, 4.0GHz)
- Windows® 10 Home 64-bit Edition
- 17.3" Full HD IPS Matte Display (1920x1080) with NVIDIA® G-SYNC Technology
- 8GB DDR5 NVIDIA® GeForce™ GTX 1070 GPU
- Opt. NVIDIA® GeForce™ GTX 1060 or 1080 GPU
- 16GB Dual Channel DDR4-2400MHz Memory
- 256GB SanDisk X400 M.2 SSD + 1TB 7200RPM Hard Drive
- 2 Hard Drives + 2 M.2 SATA SSD Drives or 2 M.2 PCIe SSD Drives capable
- Hardware Raid 0,1 Function capable
- Full sized Keyboard with color LED backlight
- Killer DoubleShot™ Pro (Killer E2400 LAN + Killer Dual Band Wireless-AC 1535) with Smart Teaming
- USB 3.1 / Thunderbolt Gen3 Combo Port
- Built-in 2.0M FHD Camera & Fingerprint Reader
- Built-in speakers and a sub-woofer
- Headphone output with ESS SABRE HIFI Audio DAC
- Sound Blaster® X-Fi™ MB5 Sound System

NP9152-S Notebook

$1,949

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- 6th Generation Intel® Core™ i7-6700K Processor (8MB Smart Cache, 4.0GHz)
- Windows® 10 Home 64-bit Edition
- 15.6" Full HD IPS Matte Display (1920x1080) with NVIDIA® G-SYNC Technology
- Opt. 15.6" 4K QFHD Matte Display with G-SYNC
- 6GB DDR5 NVIDIA® GeForce™ GTX 1060 GPU
- Optional NVIDIA® GeForce™ GTX 1070 GPU
- 16GB Dual Channel DDR4-2400MHz Memory
- 256GB SanDisk X400 M.2 SSD + 1TB 7200RPM Hard Drive
- 2 Hard Drives + 2 M.2 SATA SSD Drives or 2 M.2 PCIe SSD Drives capable
- Hardware Raid 0,1 Function capable
- Full sized Keyboard with color LED backlight
- Killer DoubleShot™ Pro (Killer E2400 LAN + Killer Dual Band Wireless-AC 1535) with Smart Teaming
- USB 3.1 / Thunderbolt Gen3 Combo Port
- Built-in 2.0M FHD Camera & Fingerprint Reader
- Headphone output with ESS SABRE HIFI Audio DAC
- Sound Blaster® X-Fi™ MB5 Sound System

NP8173-S Notebook

$1,799

After $150 Instant Savings

- 6th Generation Intel® Core™ i7-6700HQ Processor (6MB Smart Cache, 2.60GHz)
- Opt. unlocked Intel® Core™ i7-6820HK Processor
- Windows® 10 Home 64-bit Edition
- 17.3" Full HD IPS Matte Display (1920x1080) with NVIDIA® G-SYNC Technology
- 30 days No Dead Pixel Guaranteed Insurance
- 8GB DDR5 NVIDIA® GeForce™ GTX 1070 GPU
- 16GB Dual Channel DDR4-2400MHz Memory
- 256GB SanDisk X400 M.2 SSD + 1TB 7200RPM Hard Drive
- 2 Hard Drives + 2 M.2 SATA SSD Drives Capable with Raid 0,1 Function
- Full sized Keyboard with color LED backlight
- Intel® Dual Band Wireless-AC 8260 + Bluetooth
- Built-in 2.0M FHD Camera & Fingerprint Reader
- Built-in speakers and a sub-woofer
- Headphone output with ESS SABRE HIFI Audio DAC
- Sound Blaster® X-Fi™ MB5 Sound System
- Slim design with only 1.18 inch thin

NP8153-S Notebook

$1,699

After $200 Instant Savings

- 6th Generation Intel® Core™ i7-6700HQ Processor (6MB Smart Cache, 2.60GHz)
- Opt. Intel® Core™ i7-6820HK Processor
- Windows® 10 Home 64-bit Edition
- 15.6" Full HD IPS Matte Display (1920x1080) with NVIDIA® G-SYNC Technology
- Opt. 15.6" 4K QFHD Matte Display with G-SYNC
- 30 days No Dead Pixel Guaranteed Insurance
- 8GB DDR5 NVIDIA® GeForce™ GTX 1070 GPU
- 16GB Dual Channel DDR4-2400MHz Memory
- 256GB SanDisk X400 M.2 SSD + 1TB 7200RPM Hard Drive
- 2 Hard Drives + 2 M.2 SATA SSD Drives or 1 M.2 PCIe SSD Drive Capable
- Hardware Raid 0,1 Function capable with SATA Interface
- Full sized Keyboard with color LED backlight
- Intel® Dual Band Wireless-AC 8260 + Bluetooth
- Built-in 2.0M FHD Camera & Fingerprint Reader
- Headphone output with ESS SABRE HIFI Audio DAC
- Sound Blaster® X-Fi™ MB5 Sound System
- Slim design with only 1.13 inch thin

NP8172-S Notebook

$1,549

After $150 Instant Savings

- 6th Generation Intel® Core™ i7-6700HQ Processor (6MB Smart Cache, 2.60GHz)
- Windows® 10 Home 64-bit Edition
- 17.3" Full HD IPS Matte Display (1920x1080) with NVIDIA® G-SYNC Technology
- 30 days No Dead Pixel Guaranteed Insurance
- 6GB DDR5 NVIDIA® GeForce™ GTX 1060 GPU
- 16GB Dual Channel DDR4-2400MHz Memory
- 256GB SanDisk X400 M.2 SSD + 1TB 7200RPM Hard Drive
- 2 Hard Drives + 2 M.2 SATA SSD Drives Capable with Raid 0,1 Function
- Full sized Keyboard with color LED backlight
- Intel® Dual Band Wireless-AC 8260 + Bluetooth
- Built-in 2.0M FHD Camera & Fingerprint Reader
- Sound Blaster® X-Fi™ MB5 Sound System
- Slim design with only 1.18 inch thin

NP8151 Notebook

$1,299

After $50 Instant Savings

- 6th Generation Intel® Core™ i7-6700HQ Processor (6MB Smart Cache, 2.60GHz)
- Windows® 10 Home 64-bit Edition
- 15.6" Full HD Matte Display (1920x1080)
- Also available in 15.6" G-SYNC Full HD IPS Matte Display with model NP8152
- 6GB DDR5 NVIDIA® GeForce™ GTX 1060 GPU
- 8GB DDR4-2400MHz Memory
- 1TB 7200RPM Hard Drive
- 2 Hard Drives + 2 M.2 SATA SSD Drives Capable with Raid 0,1 Function
- Full sized Keyboard with color LED backlight
- Intel® Dual Band Wireless-AC 3165 + Bluetooth
- Built-in 2.0M FHD Camera & Fingerprint Reader
- Built-in speakers and a sub-woofer
- Sound Blaster® X-Fi™ MB5 Sound System
- Slim design with only 0.98 inch thin

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- Windows® 10 Home 64-bit Edition
- 15.6" Full HD IPS Matte Display (1920x1080)
- 2GB DDR5 NVIDIA® GeForce™ GTX 960M GPU with Optimus™ Technology
- 8GB DDR4-2400MHz Memory
- 1TB 7200RPM Hard Drive
- 8X DVD±R/RW/4X +DL Super Multi Drive
- 1 Hard Drive + 1 M.2 SATA SSD Drive or M.2 PCIe SSD Drive capable
- Full sized Keyboard with white-LED backlight
- Intel® Dual Band Wireless-AC 3165 + Bluetooth
- USB 3.1 support
- Built-in 2.0M FHD Camera & Fingerprint Reader

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PROCESSOR
INTEL CORE I7-6950X

SOMETIMES YOU NEED to bring out the big guns, and for Dream Machine, we want the biggest guns possible. Intel's Broadwell-E parts were the natural choice, with the i7-6950X more than doubling the core count of the i7-6700K, with 40 PCIe lanes as an added bonus. And we put it all to good use.

Yes, the i7-6700K can hit slightly higher stable overclocks (4.8~5.0GHz), but with 2.5 times as many cores, the i7-6950X is more than able to make up for the clock speed deficit. We could still push it to a stable 4.2GHz. At stock, the 6950X has a 140W TDP, but it has to drop clocks to 3.0GHz at times to stay within that limit. Running at 4.4GHz, it guzzles juice, dissipating over 250W. It also chews through benchmarks, setting several records along the way.

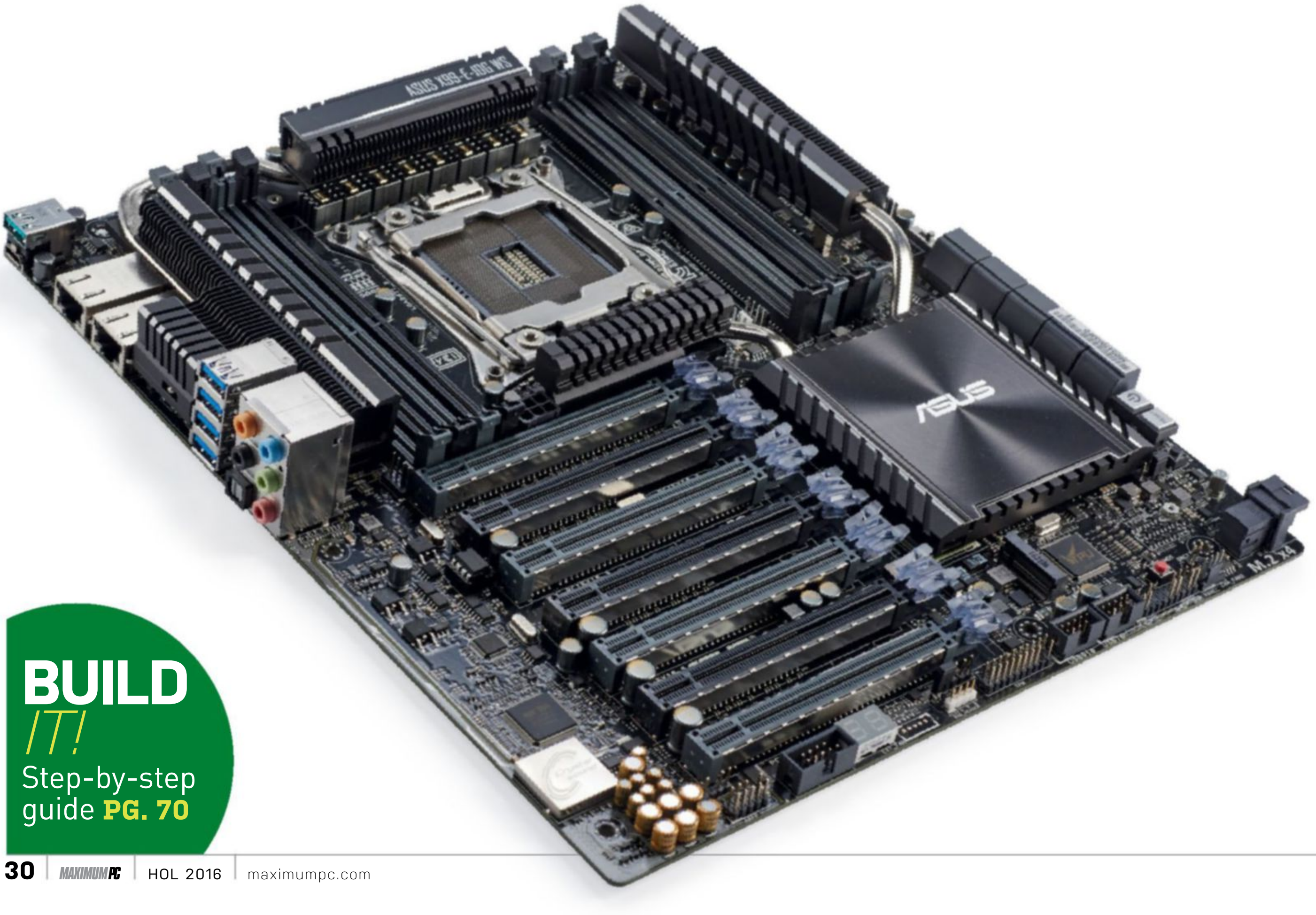
We briefly considered going for the 24-core Xeon E7-8890 v4, but Xeon chips don't support overclocking. Intel's monstrous i7-6950X strikes a happy medium.

MOTHERBOARD
ASUS X99-E-10G WS

IS THIS THE BEST MOTHERBOARD in the world? We think so. Although the price is a staggering $650, the inclusion of dual 10 Gigabit Ethernet, coupled with as many PCIe slots as you could throw a stick at, is nigh on godly. On top of that, it's beautiful. Crisp, clean, slick lines, silver accents, even the MOSFETs are gold-plated with silver trimmings. Move aside Rampage, there's a new king in town, and it's certainly not focused on gaming.

But looks aren't everything; we want performance, and the X99-E-10G WS is a monster, achieving some of the lowest undervolts we've seen with the Core i7-6950X. We knew that passively cooling the entire CPU loop without fans, while overclocking it, was going to be a challenge, but thanks to this mighty mobo, it's a challenge we easily overcame. Our overclocks aren't ice-cold, but they're damn close to what you'd expect from a standard AIO, running at 75 C under load.

And don't forget the storage support. With a U.2 connector as standard, alongside an M.2 slot, and up to 10 SATA ports, there's little you couldn't connect to this beauty.



BUILD *IT!*
Step-by-step guide **PG. 70**

GRAPHICS CARDS
DUAL MSI GTX 1080 GAMING X

DREAM MACHINE IS ABOUT MORE than gaming, though it will handle any game you throw at it. Market forces also threw us a curve ball, with Nvidia recommending against (and not actively supporting) anything more than two GPUs for SLI. Obviously, we would have liked to use two of Nvidia's new Pascal-based Titan X cards, but we couldn't quite justify it—and getting two in was proving tricky—so we turned to the GTX 1080. But which one should we use?

The fastest factory overclocked cards are often specially binned, with chips that run better, with boosted voltages, and a few other useful tweaks. We selected the MSI GTX 1080 Gaming X, which comes with a healthy factory OC—then we pushed it even further, going from the factory 1,708MHz core to an overall clock of 2,126MHz. We also redlined the memory, moving the needle from 10Gb/s to a blistering 11Gb/s.

Despite going from four-way GTX Titan X (Maxwell) to two-way GTX 1080, this year's Dream Machine delivers far better gaming performance than last year's. And even overclocked, our GTX 1080 cards use far less power than the previous gen Titan X.

MONITOR
ASUS PA329Q

WHEN YOU'VE GOT TWO of the fastest consumer graphics cards working in tandem, you need a display that's going to make the most of all that pixel-pushing power. How about a cutting-edge 4K screen that boasts quantum dot technology? Don't mind if we do. This Asus screen offers a much wider color range, thanks to the use of 3M Quantum Dot Enhancement Film (QDEF)—making it ideal for professional design work, or just for getting the best from your video, photos, and games. It's an IPS screen, as well, so great viewing angles come as standard.

This is a 4K UHD display, of course, and at 32 inches, it's a great window into whatever you're doing. The fact that it supports picture-in-picture means that you can work on several sources at the same time. It boasts an incredible array of inputs, too—try 4x HDMI 2.0 ports, Mini DisplayPort 1.2, and full-fat DisplayPort 1.2. Until 8K becomes the norm (next year maybe?), we'll happily make do with this.

HDD

HGST ULTRASTAR HE10

IN THE LAST FEW YEARS, air has given way to helium as the gas of choice to fill high-end hard drives. Helium is one-seventh the density of air, and the change in vapor reduces internal friction on the drive's moving parts. This means lower temperatures, lower energy consumption, and the ability to cram more platters than ever into a standard one-inch drive.

The Ultrastar He10 boasts 10TB of storage inside its hermetically-sealed case—the most that's available in a consumer drive. Check out our full review of the drives on page 81 if you want more info on these crazy spinners.

To put it in simple terms though, we picked an insane server-sized drive with consumer-grade speeds. Of course, we didn't just pick one. We picked four—because, why not? Only the best for the Dream Machine.

SSD

INTEL 750 SSD 750 1.2TB U.2

WE LOVE SPEED here at *Maximum PC*, which is why we grabbed this super-fast Intel 750 U.2 drive for the main task of booting this year's system. A year ago, we excitedly employed four Samsung 850 Pro SSDs to do the same job. In RAID 0. The thing is, that setup was actually slower than this drive can manage on its own—2.5GB/s versus last year's 2GB/s. So while it doesn't quite have the sheer capacity of last year's machine, it's notably faster—and notably cheaper. We're talking $2,500 for last year's bevy of Samsung drives, versus $820 for this chunky bad boy.

Of course, if we could put four of these together, we definitely would, but motherboards only come with a single U.2 connector at the moment, and it doesn't look as though that's about to change any time soon. And if you're looking for even more storage, there's nothing to stop you throwing a whole host of "normal" SSDs in your own builds.

LC Solution Coolstream PE

G.SKILL
TRIDENTZ

RAM

128GB (8X 16GB) G.SKILL TRIDENT Z F4-3200

128GB OF MEMORY IS ABSURD. Couple that with the fact we're running them at 2,666MT/s, and we're on to a crazy amount of bandwidth. Realistically, this is for the professional, the guy looking to render 8K videos and above on a daily basis. And even then, can we really justify it? Probably not. So, what we can do with all that memory, then? RAM disk. Yep. Although not the stablest of platforms, dedicating 32GB of RAM to an on-startup RAM cache would speed up data transfers and load times considerably in certain applications. And it'll still leave you with a sizable 96GB of RAM to do with what you will. Mad, right? To fill that, you would need to have 768 Google Chrome tabs open at any one time. On top of that, G.Skill's Trident Z series looks spectacular. The aluminum heatsink and sharp white accents really make each stick pop, and with eight running in quad-channel, it looks absolutely killer next to our silver EKWB waterblock, and on the X99-E-10G WS motherboard, too.

COOLING

HANDCRAFTED EKWB DUAL LIQUID-COOLED LOOP

WHEN IT CAME TO WATER-COOLING, there was only one place to go: EKWB. Our good friends over in Slovenia shipped us out all the hardware we needed to build two sweet custom loops for inside this build. Even accommodating some last-minute changes with next-day deliveries. The decision to go solely with a passively cooled radiator loop for the CPU was a bold move, but thanks to the size of the radiator, we remained confident that it wouldn't be an issue, even with an overclocked Intel Core i7-6950X.

We took advantage of four EK-Vardar fans spinning at a phenomenal 2,200rpm to keep things moving. And then, of course, the finishing touch to the design was to run hard piping instead of the soft tubing of last year. It provides us with a fair few advantages when it comes to holding tighter lines, and simply looks killer.

HEADSET
AUDIO-TECHNICA ATH-AG1X

WE DECIDED TO KEEP IT a little low key, and focus more on the hardware inside the chassis as opposed to the peripherals outside. That said, we still wanted a solid pair of cans to wrap around our ears, and couldn't think of anything better than Audio-Technica's ATH-AG1Xs. With a closed-back design, these circumaural headphones provide crisp audio, and a tremendously wide soundscape, thanks to a phenomenal 5-35,000Hz frequency response, coupled with astonishingly low distortion.

Explosions are meaty, while higher trebles retain that signature shatter. Music is equally joyous; it's not as well balanced as some audiophile solutions, but the extra bass doesn't harm the mids or upper treble. If you want the best gaming headset, you'd struggle to turn the ATH-AG1Xs aside.

BUILD *IT!*
Step-by-step guide **PG. 70**

CASE
IN WIN 909

WHAT A CHASSIS! What an insane chassis! In Win's 909 is nothing short of a dream itself. Designed and developed deep within the bowels of In Win's insanity factories, this monstrosity of shapes and angles checks all the right boxes when it comes to versatility, unique design, and overall build quality. Need expansion? You got it. Want heavy water-cooling support? It's there. Dual loops and modding potential? All included. You name it—if there's something you want to do with the In Win 909, you can.

Available in either black or silver, we opted for the stealth version to really bring your attention to the silver components and dual loops situated within its depths. The single sheet of curved brushed aluminum gleaming across the exterior of the chassis is enough to make any man weep. And with the interior featuring a similar build quality, it's not hard to see just why In Win has the prestigious reputation it does.

KEYBOARD

CORSAIR K70 LUX RGB

IS THERE A BETTER keyboard out there than Corsair's K70? You'd be hard-pressed to convince us, that's for sure. The black aluminum finish matches our build perfectly. Coupled with those Cherry MX Blue switches for a swift, subtle, tactile feedback, it's well on its way to being a winner. With dedicated media keys, a plethora of onboard RGB LED profiles, thanks to a new and updated lighting controller, USB passthrough, and that full-size layout we've all come to know and love, Corsair's K70 LUX is perfect for this build, and perfect in general.

MOUSE

STEELSERIES RIVAL 700

THE PIXART PMW3360 optical sensor lies at the heart of the Rival 700. Swappable by its very nature, if you're more of a laser guy, you can grab that one instead. SteelSeries's pedigree in mouse design is second to none, and the Rival 700 is one of our favorite mice released this year. With a fantastically comfortable ergonomic design, especially for palm grip users, seven buttons, the full RGB suite, and more modularity than your 4K screen has pixels, this beauty provides plenty to match our build.

It even has the essence of Dream Machine madness about it in the form of an OLED display and haptic feedback, if you want to know when you click that button. It's a sight to behold, and worthy of this year's PC.

PSU

BE QUIET! DARK POWER PRO 11

LAST YEAR'S Dream Machine needed two PSUs to power its pile of Titans. But thanks to the improved power efficiency of the Pascal architecture, the pair of 1080s we're using will be much less of a strain on our outlets. To keep efficiency at a maximum, we opted for the Be Quiet! Dark Power Pro 11, which offers 1,200W of power along with 80PLUS Platinum certification for up to 94 percent power conversion efficiency.

In addition to keeping our power bill down, the Dark Power Pro won't wake the baby. It uses an airflow-optimized 135mm SilentWings 3 fan, featuring a fluid-dynamic bearing, copper core, and a six-pole motor to reduce vibration. The fan opening is also funnel-shaped, allowing for high air intake.

The PSU is almost fully modular to help with cable management. It also has an overclocking key to allow switchover between quadruple independent 12V-rail and high-performance single-rail modes.

be quiet!
DARK POWER PRO
1200 WATT
80 PLUS
Warranty void if removed

CONCLUSION

WHEN TASKED WITH THE IMPOSSIBLE…

SYNERGY IS THE CREATION of a whole that is greater than the sum of its parts. It's the defining principle behind all things computational: bringing different pieces of hardware together to create a force of synthetic reckoning. Nowhere is this more apparent than in the Dream Machine, a system without limits. Does the 2016 Dream Machine deliver? We think so.

The Intel Core i7-6950X is no slouch, and it drives this monstrosity forward on a wave of its own perpetual motion, drawing scores of well over 2,000 in Cinebench. Yes, the single-core performance doesn't compete with the more consumer-friendly Skylake, but it's designed for heavy workloads and multithreaded tasks, rather than gaming—not that lacks capability in that regard….

Coupled with two massively overclocked GTX 1080s, that's a point proven well enough. Although SLI is still a bit flaky in some games, with developers often ignoring it entirely, the power unleashed by having two of these Pascal powerhouses is enough to make you weep. Thanks to some aggressive cooling from that massive triple 120mm fan rad and isolated loop, maintaining a 60fps average in most modern titles at 4K is definitely possible.

Then there's the storage. Four 10TB helium-filled hard drives line the roof of this phantom. In RAID 0, they thrash SSDs in both capacity and sequential speed. Were we irresponsible placing them in RAID 0? If this was an everyday machine, it would have been a simple RAID 1+0, allowing for speeds comparable to an SSD, except with 20TB of storage, and 20TB of redundancy—talk about an onboard NAS or what, huh?

Up against our new zero-point, this year's Dream Machine leaves it in a corner crying itself to sleep. Two water-cooled giants have butted heads—one big, one little—and, unsurprisingly, the biggest one. Only a select few benchmarks were less than a 100 percent increase in performance, and those tended to be due to the Core i7-6700K's insane single-core performance.

So, what is this machine? It's a do-all, be-all system. Capable of gaming at 4K 60fps, while simultaneously rendering video, ready for upload later in the day. Is it practical? No. But if we've noticed anything from this year's build, it's how much money we've saved, and how much performance we've gained. We'll give you a hint: it's close to $4,000, for twice as much storage, twice as much RAM, similar graphical performance, and some serious heft in the motherboard and CPU department.

COMPUTATIONAL BENCHMARKS

	ZERO-POINT	
Cinebench R15 Single (fps)	196	167 (-14.8%)
Cinebench R15 Multi (fps)	987	2,092 (112%)
X264 HD 5.0 (fps)	21.93	43.86 (100%)
PCMark 8 Creative (fps)	7,675	7,572 (-1%)
OS Drive Sequential Read (MB/s)	1,895	2,564 (35.3%)
OS Drive Sequential Write (MB/s)	949	1,318 (38.9%)
AD Storage Sequential Read (MB/s)	540	965 (44%)
AD Storage Sequential Write (MB/s)	460	967 (110%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our desktop zero-point PC uses a Core i7-6700K CPU @ 4.6GHz, an AMD R9 Fury X, and 32GB of RAM. All games are tested at max settings, with HD texture packages installed.

GRAPHICAL SYNTHETIC BENCHMARKS

	ZERO-POINT	
3DMark Fire Strike (fps)	15,026	20,947 (39%)
3DMark Fire Strike Extreme (fps)	7,248	15,302 (111%)
3DMark Fire Strike Ultra (fps)	3,922	9,478 (142%)
3DMark: Time Spy DX12 @ 1440p (fps)	5,073	12,314 (143%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our desktop zero-point PC uses a Core i7-6700K CPU @ 4.6GHz, an AMD R9 Fury X, and 32GB of RAM. All games are tested at max settings, with HD texture packages installed.

1440P GAMING BENCHMARKS

	ZERO-POINT	
Total War: Attila (fps)	27	47 (74%)
Far Cry Primal (fps)	57	84 (47%)
The Division (fps)	55	115 (110%)
Rise of the Tomb Raider (fps)	25	62 (148%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our desktop zero-point PC uses a Core i7-6700K CPU @ 4.6GHz, an AMD R9 Fury X, and 32GB of RAM. All games are tested at max settings, with HD texture packages installed.

4K GAMING BENCHMARKS

	ZERO-POINT	
Total War: Attila (fps)	14	33 (135%)
Far Cry Primal (fps)	34	68 (100%)
The Division (fps)	34	45 (32%)
Rise of the Tomb Raider (fps)	9	40 (344%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our desktop zero-point PC uses a Core i7-6700K CPU @ 4.6GHz, an AMD R9 Fury X, and 32GB of RAM. All games are tested at max settings, with HD texture packages installed.

IN WIN
IN WIN
IN WIN
IN WIN
be quiet!
DARK POWER PRO
1200 WATT
IN WIN

BUILD
IT!
Step-by-step
guide **PG. 70**

XOTICPC
Pin to Start
Unpin from taskbar
Manage
Properties
Map network drive
Disconnect network drive
msi
DYNAUDIO

100 TIPS & TRICKS FOR WINDOWS 10

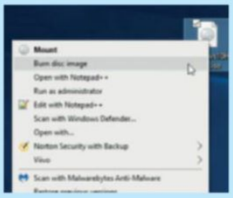
We reveal 100 essential hints, tips, and secrets for getting more out of Windows 10

You may have been using Windows for years, or you may be a newcomer to the PC, but, either way, there's always something new to learn, and for more seasoned users, there are plenty of hidden tricks that will make your day-to-day computing life that bit easier. Whichever camp you fall into, we've unearthed 100 great ways of improving Windows—they're written for Windows 10, but many work with earlier versions of Windows, too.

There are many impressive tools and options built into Windows. Some of these are obvious and easy to discover, but there are numerous other secrets that you can reveal just by scratching beneath the surface of your Windows OS.

Over the coming pages, we'll share some of the best Windows advice. Our top 100 tips include basic hints to make life easier, such as changing the order of your Taskbar, or locking your computer with a simple key press, to more under-the-hood tasks, such as clearing up free space, or creating an emergency boot disk.

So, turn the page and read on for a wealth of information about Windows.



01 Burn ISO disc images

Just right-click an ISO file, and select the "Burn disc image" option. Select the disc burner you'd like to use, insert a blank disc, and click the "Burn" button

02 Re-order the Taskbar

Inject a little order into the Taskbar by rearranging its icons. Just click and drag an icon to its new place—you'll see the other icons move along to make way.

03 Quickly launch Taskbar apps

You don't need to use the mouse to launch programs that have shortcuts in the Taskbar. Press Win-1 to launch the first icon on the Taskbar, and so on.

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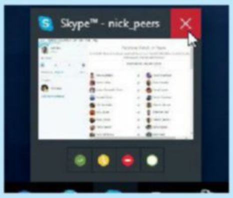
17/05/2016

04 Quickly check the desktop

No need to minimize all your open windows to view the desktop—just move the mouse to the lower right-hand corner of the screen, and they temporarily vanish!



05 Close apps without switching to them

Hover the mouse cursor over a Taskbar button, and click the red cross located on the upper-right of a preview to close it completely.

06 Run two programs side by side

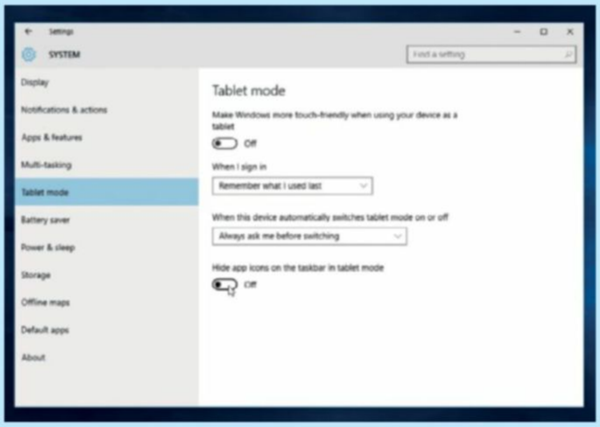
Don't bother manually resizing program windows—just drag a window to the left side of the screen, and it expands to fill half of it. Repeat with another window to the right to see both side by side. Windows can be un-docked by dragging them out of position again.

07 Use pinned folders for fast access

If you use the same folders often, pinned folders come in handy. To pin a folder to Windows Explorer's jump list, open File Explorer, then drag a folder into the Quick Access list—not only will it be visible from here, but when you right-click the File Explorer Taskbar icon, you'll find the pinned folder is there, too.

08 Fine-tune your hybrid tablet/PC

If you've bought a cheap two-in-one tablet/laptop device, and you're frustrated by Windows switching automatically between tablet and laptop mode when you undock your keyboard, simply open Notification Center and tap "Tablet Mode" to switch manually. Click "Start → Settings," and browse to "System → Tablet mode" to tweak related settings, such as leaving the Taskbar on-screen at all times, even in Tablet mode.



Tablet mode

Make Windows more touch-friendly when using your device as a tablet
Off

When I sign in
Remember what I used last

When this device automatically switches tablet mode on or off
Always ask me before switching

Hide app icons on the taskbar in tablet mode
Off

09 Launch a new program window

When a program is running and you click its Taskbar icon, you switch to that app. If you would prefer to launch a new window, just hold down the Shift key as you click the icon.

10 Gain more desktop space

The Taskbar is useful, but you may not need it displayed at all times. To maximize the size of your desktop, right-click an empty section of the Taskbar, and select "Properties." On the Taskbar tab, check the box labeled "Auto-hide the Taskbar," and click "OK." The Taskbar disappears until you move your mouse to the very bottom of the screen—it then slides into view.

11 Move between your monitors

If you've got more than one monitor connected to your computer, you can avoid having to drag and drop windows between screens by simply pressing the keyboard combo Win-Shift along with the left or right arrow keys.

12 Task switching and virtual desktops

Windows 10 introduces a new Task Switcher—simply press Win-Tab, and you'll see all of your open windows shrink to fit on your screen. Either click one to switch to it, or drag it to "Desktop 2" at the bottom of the screen to transfer it to another (virtual) desktop. You can organize windows over multiple desktops (click "+" to create new ones) by dragging them to the desired desktop. Hold Ctrl-Win, and hit the left and right arrow keys to move between desktops.

13 Easy compression for larger files

Need to send a number of files to someone, but worried they're too large to attach to an email? Just select all of the files you want to work with, right-click, and then select "Send To" followed by "Compressed (zipped) Folder."

14 Preview program Windows

With more than one instance of a program running, you may not be able to tell which one you want to switch to next. To make things a little easier, hover the mouse over a program's Taskbar button to display a preview of any currently running program. Move the mouse over one of the previews, and you can take a peek at a full-screen preview, then click to switch.

15 Lock with a key press

Stepping away from your computer for a couple of minutes? Keep it safe by pressing Win-L to lock it. It's that simple!

16 Scroll inactive windows

Windows 10 makes it possible to scroll windows that aren't active—just roll your mouse over the window, then use your wheel to scroll without clicking to select the window. Switch this feature off via "Settings → Devices → Mouse & touchpad" if it annoys you.

17 Compatibility mode

Some older software that you rely on may not work as you expect under Windows 10. Try right-clicking the shortcut of a troublesome program, then select "Properties → Compatibility tab." Check the box in the "Compatibility Mode" section, and select the version of Windows it worked with— this setting may get it up and running again.

18 Taskbar buttons on your terms

Windows saves space by combining windows from the same app into one Taskbar icon. Prefer to see each window individually? Right-click the Taskbar, select "Properties," and use the "Taskbar buttons" drop-down menu to choose between the "Always combine, hide labels" and "Never combine" options.

19 Calculate and convert

The calculator is capable of much more than simple addition and subtraction—click the menu button, and you'll find scientific and programmer options, a date calculator, and various unit conversions, too.

20 Change window sizes with a shortcut

There are lots of ways you can change the size and position of an open window. Hold Win and press the up arrow to maximize a window, or the down arrow to minimize it. You can also use Win in conjunction with the left and right arrow keys to snap the currently selected window to the left or right-hand side of the screen. Quickly tidy things up by pressing Win-Home to minimize everything except the current window, too.

21 Custom window sizes

Visit www.brianapps.net and download Sizer 3.4—this tool enables you to resize windows to custom-set sizes. Due to changes in Windows, make the width 14 pixels longer than you need, and the height seven pixels—for example 1294x807 for 1280x800.

22 Re-arrange the notification area

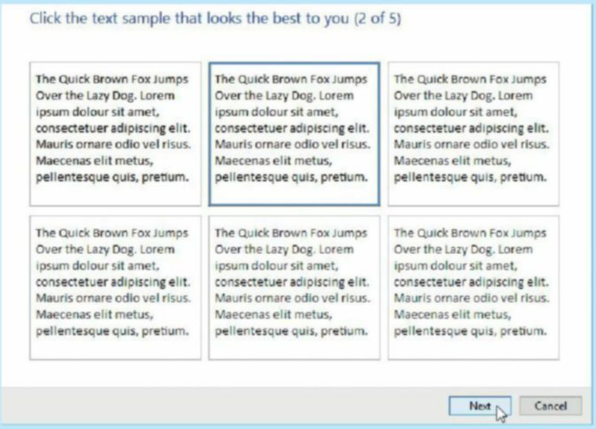
If you don't like how icons are ordered in the notification area of the Taskbar, they can be simply dragged and dropped into new positions. Perfect for tailoring the Taskbar to suit your needs.

23 Free up disk space

To keep your hard drive running well, it's a good idea to clear out the clutter. Type "cleanmgr" into the Search bar to quickly launch Windows' own Disk Cleanup tool, or download CCleaner from www.piriform.com for a more powerful cleaning app.

24 Minimize all windows at once

To quickly minimize all of your open programs and windows, press the Win-M key combo at the same time. Alternatively, grab a window with your mouse and shake it. This gesture leaves the shaken window alone, but minimizes all others.



Click the text sample that looks the best to you (2 of 5)

The Quick Brown Fox Jumps Over the Lazy Dog. Lorem ipsum dolour sit amet, consectetuer adipiscing elit. Mauris ornare odio vel risus. Maecenas elit metus, pellentesque quis, pretium.

The Quick Brown Fox Jumps Over the Lazy Dog. Lorem ipsum dolour sit amet, consectetuer adipiscing elit. Mauris ornare odio vel risus. Maecenas elit metus, pellentesque quis, pretium.

The Quick Brown Fox Jumps Over the Lazy Dog. Lorem ipsum dolour sit amet, consectetuer adipiscing elit. Mauris ornare odio vel risus. Maecenas elit metus, pellentesque quis, pretium.

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The Quick Brown Fox Jumps Over the Lazy Dog. Lorem ipsum dolour sit amet, consectetuer adipiscing elit. Mauris ornare odio vel risus. Maecenas elit metus, pellentesque quis, pretium.

25 ClearType looks amazing

ClearType ensures text looks great on screen, but it can be fine-tuned. Click "Start," and type "cttune" to access the ClearType Text Tuner, where you're guided through the process.

26 Preview your fonts

Open the Fonts folder from the Control Panel, and you can preview the fonts you have installed without even having to run anything. Any you don't need can be hidden or deleted—we recommend backing these up first by copying them to another folder.

27 Select your files more easily

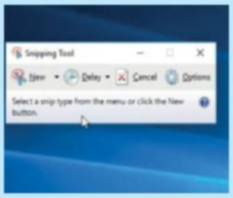
When you need to select multiple files, it can be quicker and easier if you use check boxes. Open File Explorer and switch to the "View" tab. Check the "Item check boxes" box, and when you roll your mouse over a folder or file, you'll see a check box appear—check this to select the file, then repeat for all the others you wish to select.

28 USB speed-up

Speed up an older PC with 2GB RAM or less by simply inserting a USB drive! Plug one in, and in the AutoPlay menu that appears, select the "Speed up my system" option to enable the ReadyBoost feature. You can then choose how much space should be used to help your computer's memory.

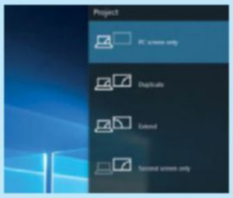
29 Show all your drives

If you would prefer to see all drive letters at all times, click "Options" under the File Explorer ribbon's "View" tab. Next, select this dialog's "View" tab, uncheck the box labeled "Hide empty drives," and then click "OK"—now all of your drive letters are visible, even those with no media inserted.



30 Take screenshots

The Snipping Tool is the perfect way to capture an image of what's happening on your desktop—particularly handy for screenshots and troubleshooting.

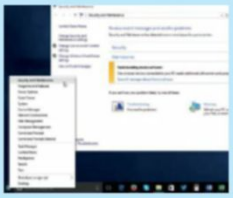


31 Project your desktop

Built-in support for projectors means that connecting your laptop to a projector is incredibly simple. Just hit Win-P to view projector options.

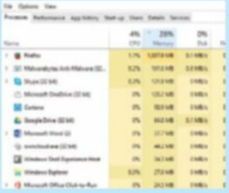
32 Check PC performance

You can manually run the Windows Experience Index tests in Win 10 by installing the WEI Tool from http://winaero.com/download.php?view.79.



33 Where's the Action Center?

Wondering where it's gone? Type "action" into the Search box, and click "Security and Maintenance" to find notifications of problems and fix-it tools.



34 Check your memory usage

To see which running apps use up memory, right-click Taskbar, select "Task Manager," then "More Details."

35 Avoid the Registry

Want to tweak Windows settings without getting your hands dirty? Download and run Ultimate Windows Tweaker 4.0 from http://bit.ly/uwt-win10, where you'll find loads of handy tweaks and customization settings that require a single click to apply. Take a Restore Point before you begin using the handy button in the app.

36 Give network locations a letter

If you have a frequently accessed network folder, speed things up by assigning it a drive letter. Navigate to the network location in Explorer, right-click it, and select "Map network drive," then choose your new drive letter.

37 View clocks from other time zones

The Taskbar shows you the current time, and can also be used to check the time in up to two other countries. Click the time in the Notification area, and choose "Date and time settings." Scroll down and click "Add clocks for different time zones." Check "Show this clock," and use the drop-down menu to configure it.

38 Restore libraries

Libraries are hidden by default in Windows 10—bring them back by switching to the "View" tab of File Explorer, then click the "Navigation pane" button, and pick "Show libraries."

39 Personalized display calibration

If you like to be in complete control over how your display is calibrated, type "dccw" into the Search bar to access the Display Color Calibration Wizard. To proceed, click "Next," and the wizard then helps you to choose the best display settings.

40 Restore classic looks

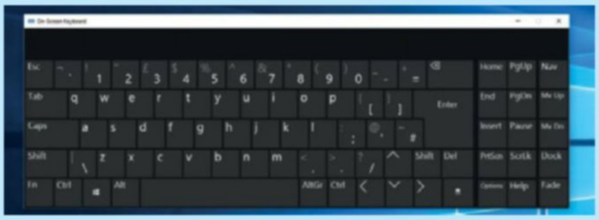
If you don't like the way the way certain items are now displayed in the Notification area of the Taskbar (we're looking at you, battery, time and date display, and volume control), you can restore the old look. Ordinarily, you'd need to tweak the Registry, but simply fire up Ultimate Windows Tweaker (see Tip 35), then go to "Customization → Windows 10 tab," where you'll find the options you need.

41 Cycling backward

The Classic task switcher (Alt-Tab) still remains—tap it to cycle forward through the list of windows. Hold Shift as well as Alt and Tab, and you can cycle backward, too.

42 Disable hibernation and free up space

Windows' hibernation file takes up a lot of space, particularly on machines with lots of RAM. Disable it to recover the space by right-clicking the "Start" button, and choosing "Command Prompt (Admin)." Type "powercfg -h off" and hit Enter.



43 On-screen keyboard

If you're having trouble with your keyboard, and need to buy a new one, there's an on-screen one you can use in the meantime. Type the command "osk" into the Cortana Search bar, and press Enter to bring it up.

44 Activate windows without clicking

Want to bring windows into focus simply by rolling the mouse over them? Type "ease of access" into the Search bar, then choose "Ease of Access Center." Click the link labeled "Make the mouse easier to use," and then select the option labeled "Activate a window by hovering over it with the mouse" in the "Make it easier to manage windows" section.

45 Quick and easy command prompt

Hold Shift while right-clicking a folder, and you'll reveal the previously hidden "Open command window here" option. This option takes you to that location in the command prompt window.

46 Run as administrator

You can run any program in the Taskbar in the role of an administrator by simply holding down Ctrl-Shift at the same time.

47 Take control of UAC

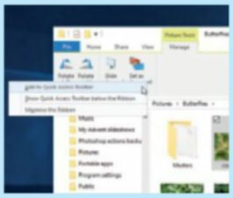
User Account Control is a great security feature, and you can adjust just how sensitive it is to suit your preferences. Click the "Start" button, type "uac," and press Enter. You can then use the slider to choose when warnings should appear.

48 Cycle through a single app

We all know that Alt-Tab is a handy shortcut for cycling through programs. If you want to cycle through just one program's open documents or windows, hold down the Ctrl button, and click its Taskbar icon until you access the window you're looking for.

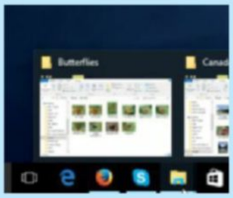
49 Open File Explorer at This PC

Open File Explorer and it defaults to the Quick Access folder. If you'd rather it went to your drives instead, select "Options" under the "View" tab, and choose "This PC" from the drop- down menu.



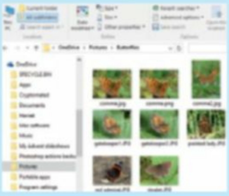
50 Favorite commands

Make favorite ribbon commands more accessible in any supported app: right-click the option, and choose "Add to Quick Access Toolbar."



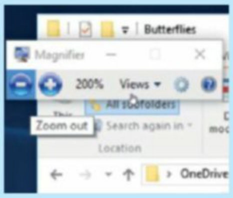
51 Quickly close windows

When looking at a Taskbar preview of a program or window, just click the middle mouse button to close the window without having to switch to it.



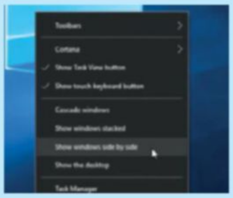
52 Jump to search

When you want to search for a file within a particular folder, simply press F3 to jump to the search box, enter your chosen search term, then hit Enter.



53 Zoom in and out

To get a better view of what's happening on your desktop, or in a program, press Win and "+" to zoom in. Use Win and "-" to zoom out again.



54 Arrange your window

Right-click the Taskbar and click either "Show windows stacked" or "Show windows side by side." You can right-click again to access the undo option, too.

55 Create your own shortcuts

Create custom keyboard shortcuts to launch your favorite programs. Right-click a program shortcut, pick "Properties → Shortcut tab," select the "Shortcut key" field, press the keyboard combo you'd like to use, then click "OK."

56 Get more from your large monitor

Massive monitors with super-high resolutions can make on-screen text too small to read easily. Adjust this via "Start → Settings → System → Display"—use the "Change the size of text, apps, and other items" slider to push things up. Type "DPIScaling" into the Search bar to access another dialog box, where you can control specific items.

57 Side-screen Taskbar

If you'd prefer to make better use of the width of your widescreen monitor, move the Taskbar to the left or right, rather than the bottom of the screen. Right-click an empty section of the Taskbar, and make sure that the "Lock the Taskbar" option does not have a check next to it (if it does, just click it to remove it). You can then drag and drop the Taskbar to your preferred position, before locking it in place again. Give it a try!

58 Record any problems you experience

There may be times when you run into a problem with your computer, and don't know how to remedy it. It can be difficult to explain what's going wrong to someone else, which is where Problem Steps Recorder can help—it makes it possible to record what happens on screen, and send it to someone who might be able to help. Type "psr" into the Search bar, and choose "Steps Recorder." Click "Start Record," and use your computer until the problem occurs again. Click "Stop Record" before saving and emailing the file.

59 Send To more places

The "Send To" section of the context menu is very useful. If you hold down Shift while right-clicking a file or folder, you'll see an expanded list of options in the submenu that appears.

60 See how your PC is being used

Windows' Resource Monitor enables you to see how your processor, memory, and hard drive are being used. Press Win-R, type "resmon," and press Enter. The graphs reveal how individual programs and processes are making use of your hardware.

61 Repair a problematic PC

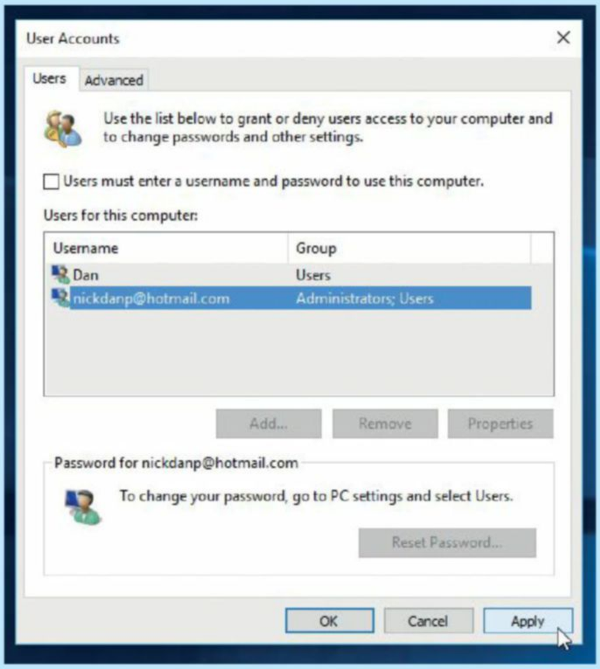
Problems can arise, and you may wish to reboot into a Windows troubleshooting mode. To do this manually, hold Shift as you click "Start → Power → Restart" to boot into the Advanced Start-up screen. You'll find a number of options here—to get into Safe mode, for example, select "Troubleshoot → Advanced Options → Start-up Settings → Restart," then select your chosen mode—"4" for Safe mode on its own, or "5" for Safe mode with Internet access—to boot into it.

62 Switch key windows to a darker theme

Windows 10 offers a hidden dark theme for system settings and built-in apps. Open Ultimate Windows Tweaker, and select "Customization → Windows 10." Uncheck both "Apps Use Light Theme" and "System Uses Light Theme," and click "Apply." The change is immediate, and you can easily reverse it by simply checking both boxes again.

63 Control AutoPlay

Click "Start → Settings → Devices → AutoPlay," and you can take control of what happens when you insert a disc, or plug in an external drive. You can opt to disable AutoPlay completely as well.



Use the list below to grant or deny users access to your computer and to change passwords and other settings.

☐ Users must enter a username and password to use this computer.

Users for this computer:

Username	Group
Dan	Users
nickdanp@hotmail.com	Administrators; Users

Password for nickdanp@hotmail.com

To change your password, go to PC settings and select Users.

64 Log on automatically

Get to work faster. Press Win-R, type "netplwiz," and press Enter. Uncheck the box labeled "Users must enter a user name and password to use this computer," then select your account before clicking "Apply," and entering your password when prompted. Click "OK" and you're done!

65 Save Office files in WordPad

It might seem like a simple tool, but the WordPad program has more capabilities than you might think. If you click the "File" option, followed by "Save As," you can save in the Office DOCX format without the need for additional software or applications.

66 Leave yourself a helpful note

There's no need to clutter your desk with a hundred different paper notes and reminders—you can leave electronic reminders on your desktop instead. To do this, launch the Sticky Note tool from the Start menu, and create notes as and when you might need them. You can even right-click notes to customize their color. This simple feature is a great way to help them to stand out.

67 Play music on another computer

Windows Media Player can be used to play local or network music files, but you can also push music to play on another computer as well. You need to set this up in advance, so launch Windows Media Player, click the "Stream" button, and then select "Turn on media streaming." In the window that appears, click the "Turn on media streaming" button. Back in Windows Media Player, click the "Stream" button again, and then select "Allow remote control of my player → Allow remote control on this network." Next, select "Stream," followed by "Automatically allow devices to play my media"—repeat on other computers on your network. Then right-click a music file, and select "Cast to Device," before selecting a PC or other device for playback.

68 Restore Windows Photo Viewer

You'll either love or hate Windows 10's new Photos app. If you hate it, this following tweak enables you to

restore the classic Windows Photo Viewer as the default: open Ultimate Windows Tweaker again, switch to the "Additional" section, and click "Enable Windows Photo Viewer." Once done, make it the default for viewing photos once more under "Settings → System → Default apps."

69 View a slideshow on your desktop

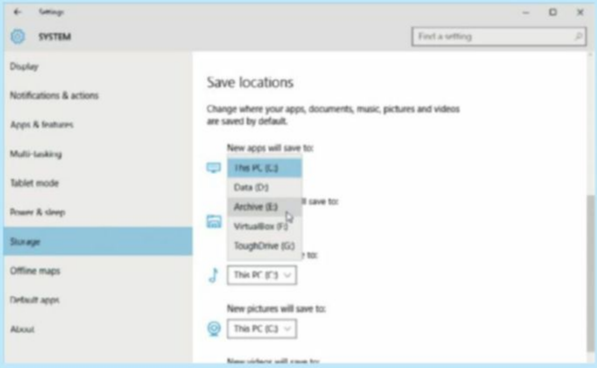
Can't decide which picture to use as your background? Use a rotating slideshow instead. Right-click the desktop, then select the "Personalize" option. Click the "Background" drop-down menu, and choose "Slideshow." You're prompted to select a folder containing the images you wish to include—do so, and decide how frequently the image will change. This is great for keeping the boring old desktop fresh and interesting.

70 Old-style Taskbar context menus

When you right-click a button in the Taskbar, you gain access to jump lists. If you'd prefer to see options to maximize, minimize, and close windows instead, hold down Shift while you right-click the Taskbar button.

71 Move apps to new drive

If you're running out of space on your hard drive—or have a tablet with limited onboard storage—navigate to "Settings → System → Storage," and scroll down to the "Save locations" section. Click the drop-down menu under "New apps will save to," and select another drive with more space. You can move some (but not all) existing Windows Store apps, too, if space is really tight—switch to "Apps & features," then click the app you'd like to transfer. If "Move" isn't grayed out, click it, select your destination, and click "Move" again to transfer the app.



Save locations

Change where your apps, documents, music, pictures and videos are saved by default.

New apps will save to:

New pictures will save to:

New videos will save to:

72 Desktop tidying

If you have icons everywhere, right-click the desktop, and choose "View → Auto arrange icons."

73 Customize Send To

Many programs add entries to the "Send to" menu, but you can also add your own. The simplest way is with the help of Send To Toys (http://gabrieleponti.com/software).

74 Get more screen space

You can see more of the desktop and your running programs by shrinking your Taskbar buttons. Right-click the Taskbar, and select "Properties"—on the Taskbar tab, check the box labeled "Use small Taskbar buttons" to shrink them.

75 Get more Taskbar

Conversely, you might want a larger Taskbar, so you can see more buttons or extra running programs. Right-click the Taskbar, and ensure the "Lock the Taskbar" option is not checked. You can drag the top of the Taskbar upward to make it even taller.

76 Tweak your Quick Access settings

The Quick Access area in File Explorer juggles frequently and recently accessed folders with pinned folders of your choosing. Switch to the "View" tab, and click "Options" to choose whether or not to display recent files and frequent folders here.

77 Keep browsing in private

You can keep your browsing history private in the new Edge browser by switching to InPrivate mode. You can do this by pressing the combo Ctrl-Shift-P.

78 Reduce system sounds for calls

To prevent the music you're listening to interfering with computer-based phone calls, you can opt to automatically have the volume level of system sounds reduced when a call is underway. Right-click the speaker icon in the notification area, and select the "Sounds" option. Move to the "Communications" tab, and select one of the three options to reduce volume or completely mute sounds.

79 View all notification icons

Windows saves space by hiding some icons from the notification area. To see them at all times, click "Start → Settings → System → Notifications & actions," and click "Select which icons appear on the Taskbar." Make sure you flick the switch labeled "Always show all icons and notifications on the Taskbar" to "On."

80 Undo that unintentional move!

If you accidentally move, copy, or send a file to the Recycle Bin, you can press Ctrl-Z to reverse the mistake. Phew!

81 Check your energy efficiency

Right-click the "Start" button and choose "Command Prompt (Admin)." Type "powercfg -energy" and press Enter. After a minute or so of loading, navigate to the folder you're told about (typically C:\Windows\System32), and open up the file energy-report.html. This shows you what to do to improve energy efficiency.

82 Make individual settings accessible

Got a favorite tweak you frequently find yourself burrowing into Settings to find? You can create one-click shortcuts to them a number of different ways. The simplest thing to do is pin it as a tile to the Start menu, simply by locating it in "Settings," then right-clicking its entry in the left-hand pane, and choosing "Pin to Start."

83 Choose your shutdown options

The power button can be used to do many things—restart, shut down, sleep, and so on—and you can choose what should happen by default. Right-click the "Start" button, select "Power options," then click "Choose what the power buttons do" to access the relevant options.

84 Add tabs to File Explorer

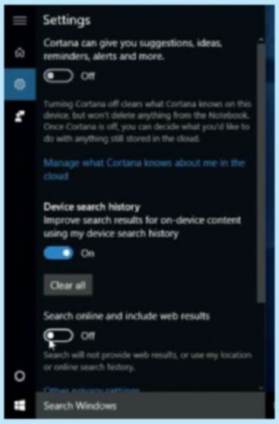
File Explorer in Windows 10 is an improvement on Windows 7, but it's still lacking in one key area: no tabbed support to prevent you cluttering up the desktop with multiple windows. Clover 3 is a free extension that adds Chrome-like tabs to File Explorer—go to www.ejie.me to get it.

85 Undelete your files

It's easy to forget how handy the Recycle Bin folder is. If you've deleted a file, document, or folder that you need back, open up the Recycle Bin from the desktop, and you'll find your files are there ready to be restored.

86 Search with Cortana

Type the name of a file or folder into the Cortana search box, and you'll get a load of irrelevant results—click "My stuff" to search your hard drive and other storage, including your OneDrive folder, for your missing files. Use the "Show" drop-down menu to filter the results.



Settings

Cortana can give you suggestions, ideas, reminders, alerts and more.

Off

Turning Cortana off clears what Cortana knows on this device, but won't delete anything from the Notebook. Once Cortana is off, you can decide what you'd like to do with anything still stored in the cloud.

Manage what Cortana knows about me in the cloud

Device search history

Improve search results for on-device content using my device search history

On

Search online and include web results

Off

Search will not provide web results, or use my location or online search history.

91 Restrict Cortana

By default, Cortana favors web results over locally stored content. You have to click "My Stuff" to search locally. If you have no use for Cortana as a web search tool, open it, click the notebook icon on the left, then select "Settings." Flick the top switch to "Off," which reveals a new switch: "Search online and include web results." Flick it to "Off," and you'll see the search box now only says "Search Windows."

87 Talk to your PC

If you can't type very quickly, or just fancy trying out something a little nifty, type "speech" into the Search box, and select "Windows Speech Recognition." Here you'll find everything you need to configure your PC for voice-activated control—it's great for dictation, too.

88 Monitor the children

While parents want to let their child use a computer, they also want to ensure their kids are kept safe. Go to "Start → Settings → Accounts → Family & other users" to set up user accounts for your children that you can configure to protect them while online, plus manage their computer usage, and monitor what they do.

89 Account shortcuts

Click "Start" followed by your user picture, and you'll see some handy options: lock, sign out, and switch user, plus access the "Change account settings" screen.

90 Pin saved searches to the Start menu

File Explorer's search tool is powerful—for example, you can set up a search to reveal all recently modified Word documents in a folder from that location: just type "type:word datemodified:this week" into Search. Click "Save search" to add it to your Searches folder, then go there, right-click the search, and choose "Pin to Start."

92 All settings in one place

It's been dubbed "God Mode," but it is just a handy way to access a massive range of options in one place. Create a new folder, and type the name "xxx.{ ED7BA470 -8E54-465E-825C-997120 43E01C}." You can change the "xxx" to anything you like, and when you open up the folder, you're presented with a list of Control Panel options to work with, including tweaks not found in the newer Settings app.

93 Launch a website from the Taskbar

Sometimes, it can be too much trouble to switch from the program you are working in, move to a browser, and place the cursor in the address bar, before typing a URL. Instead, type the web address you want to visit into the Cortana search bar, and it goes straight there in your default web browser.

94 Create a boot disc

It's good to be prepared, and this is where a recovery drive comes into play. Type "recovery" into the Search bar, and choose "Create a recovery drive." If you have a Windows installation disc, uncheck "Back up system files to the recovery drive" to save space, before clicking "Next," then select a USB flash drive to create the drive on. If necessary, boot from this drive to access repair options when Windows itself refuses to boot.

95 Use encryption with your drives

If you're running Windows 10 Pro, type "bitlocker" into the Search bar to switch on Bitlocker drive encryption; if not, download the free VeraCrypt app from https://veracrypt.codeplex.com.

96 Give your startup a good speed-up

Right-click any shortcuts to programs you don't need in the "Start-up" group of the Start menu, and delete them. This helps to significantly reduce your computer's boot times.

97 Create new folders quickly

There's no need to lift your hands from the keyboard when you need to create a new folder in Explorer. To carry out this handy trick, use the special keyboard shortcut Ctrl-Shift-N, type a name for the folder, and press Enter.

98 Personalize your PC's information

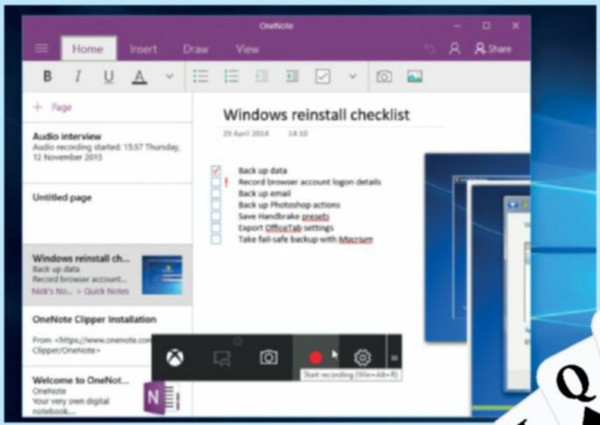
You can change what's displayed in the System Properties screen to just about anything you like (within reason). The information is held in the Registry, but why fiddle about there? Instead, fire up Ultimate Windows Tweaker, and navigate to the "Additional" section. Click the "Edit OEM Information" button, and enter your details—you can even include a logo, too. You'll need to prepare a 120x120-pixel image in your image editor, and save it with the .BMP extension, otherwise it won't appear.

99 Make good use of the Quick Access menu

Right-click the "Start" button, or press Win-X, and you open up a hidden Start menu. It provides a number of convenient shortcuts to powerful tools, including various Control Panel applets, Device Manager, and the Command Prompt. Add your own, or rearrange and delete existing shortcuts, courtesy of the Win+X Menu Editor. Download the app from http://winaero.com/download.php?view.21, and you'll find it's easy to add handy presets, such as Control Panel applets and administrative tools, as well as custom shortcuts.

100 Record app actions in Windows 10

Windows 10 features a Game DVR function, which enables you to record your progress in a game as a movie, if your hardware supports it. What's less well known is that this DVR function works with any app you install from the Windows Store. Simply press Win-G when inside your target app, and check "Yes, this is a game" when prompted. If you plan to share your video with others, it makes sense to set it to the correct aspect ratio: 16:9 or 16:10 is usually best. Use Sizer (see Tip 21) if you're struggling to get the window size perfect for your intended audience. ⏻



Audio interview

Audio recording started: 15:57 Thursday, 12 November 2015

Untitled page

Windows reinstall ch...

Back up data

Record browser account...

Nick's No... > Quick Notes

OneNote Clipper Installation

From <https://www.onenote.com Clipper/OneNote>

Welcome to OneNot...

OneNote

Your very own digital notebook...

Windows reinstall checklist

29 April 2014 14:10

- ☑ Back up data
- ☐ ! Record browser account logon details
- ☐ Back up email
- ☐ Back up Photoshop actions
- ☐ Save Handbrake presets
- ☐ Export OfficeTab settings
- ☐ Take fail-safe backup with Macrium

Start recording (Win+Alt+R)

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TECH PORN

Asus ROG GX800

THIS IS PROBABLY THE MOST ridiculous thing you've ever seen, right? If the answer is "no," well, er, you'd better stop reading now. This is Asus's latest and greatest ROG GX800. In a word, it's astronomical. It is without doubt the absolute pinnacle of computational hardware we've ever seen in a notebook to date. If you can call it a notebook. It comes packed with an Intel Core i7-6820HK, 32GB of DDR4, two 256GB Samsung PCIe SSDs in RAID 0, and not one but two Nvidia GeForce GTX 1080s running in SLI. All of which is then water-cooled by this luxurious aluminum-clad dock, ready to pump out the absolute maximum in performance whenever you need it. No expense has been spared in the creation of this silicon behemoth, something which is equally represented in its price. Even to have Asus refill the water-cooled loop will set you back $150.

So, what's different compared to last time? Well, apart from the hardware upgrade, of course, Asus is cooling both the CPU and the GPU this time around, allowing for some absolutely insane overclocks. Asus reckons you can easily top 4.4GHz alone on the processor, and up to 1,900MHz-plus on those GTX 1080s. That's as close to desktop levels of performance as you'll ever see. Is it worth it? Only you can really answer that. **–ZAK STOREY**

1 IPS 120HZ SCREEN

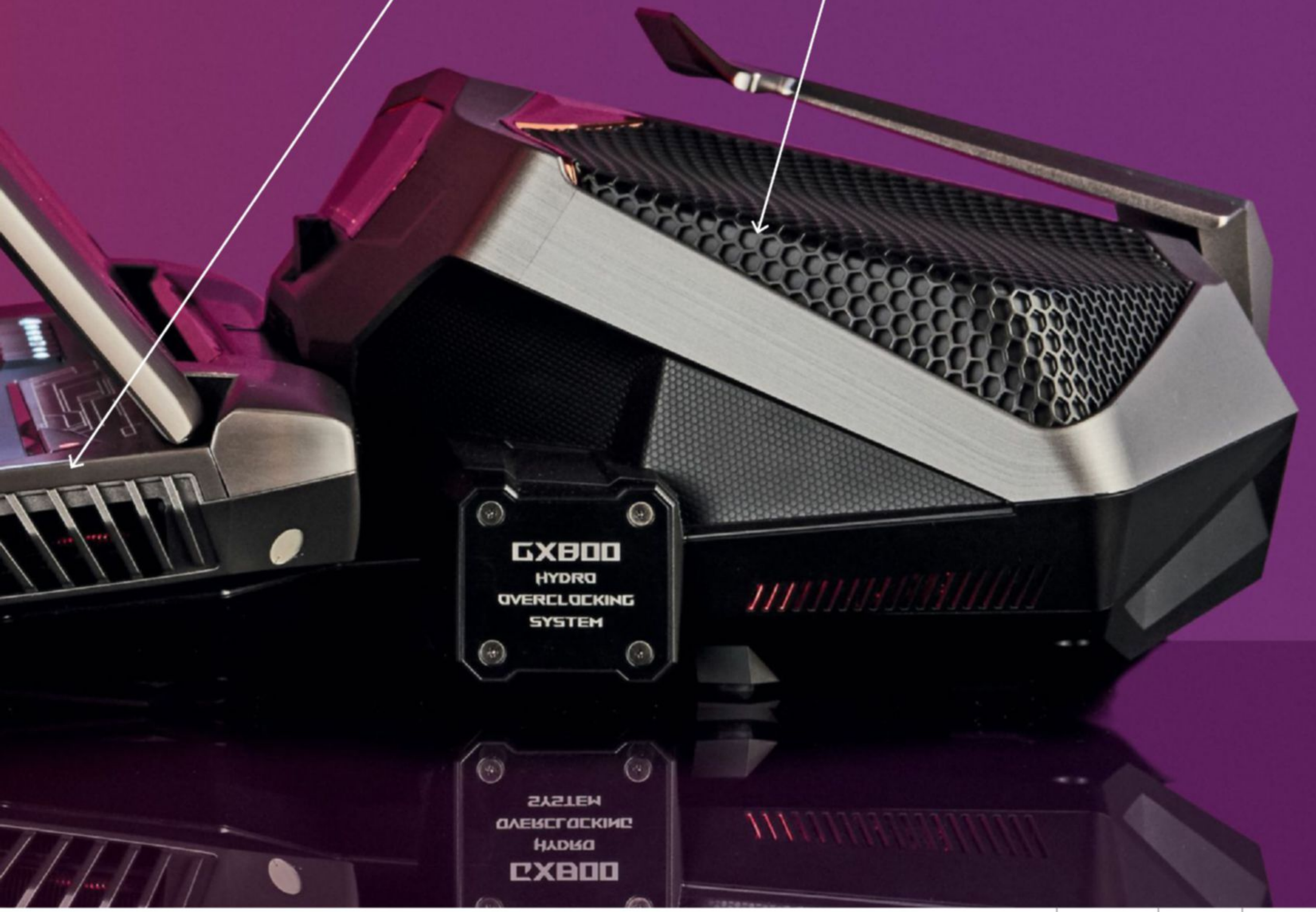
The zenith of screen tech on a laptop: 120Hz, 1080p, 17 inches of IPS glory. There's little more you could ask for, really. Color reproduction is near perfect, viewing angles vast, and pixel density damn near bang-on.

2 GTX 1080 SLI

Is this the most powerful graphics setup currently available to both desktop and notebook solutions? Packed into a 1080p screen at 120Hz, it's beyond future-proof—we'd be surprised if this didn't last you for the next five to six years minimum.

3 DUAL 120MM RADIATORS

Asus's in-depth cooling solution is a little more advanced this time around, yet it still retains its simplicity. Just place the laptop down gently on the mounting points, pull the metallic lever down, and you're done.



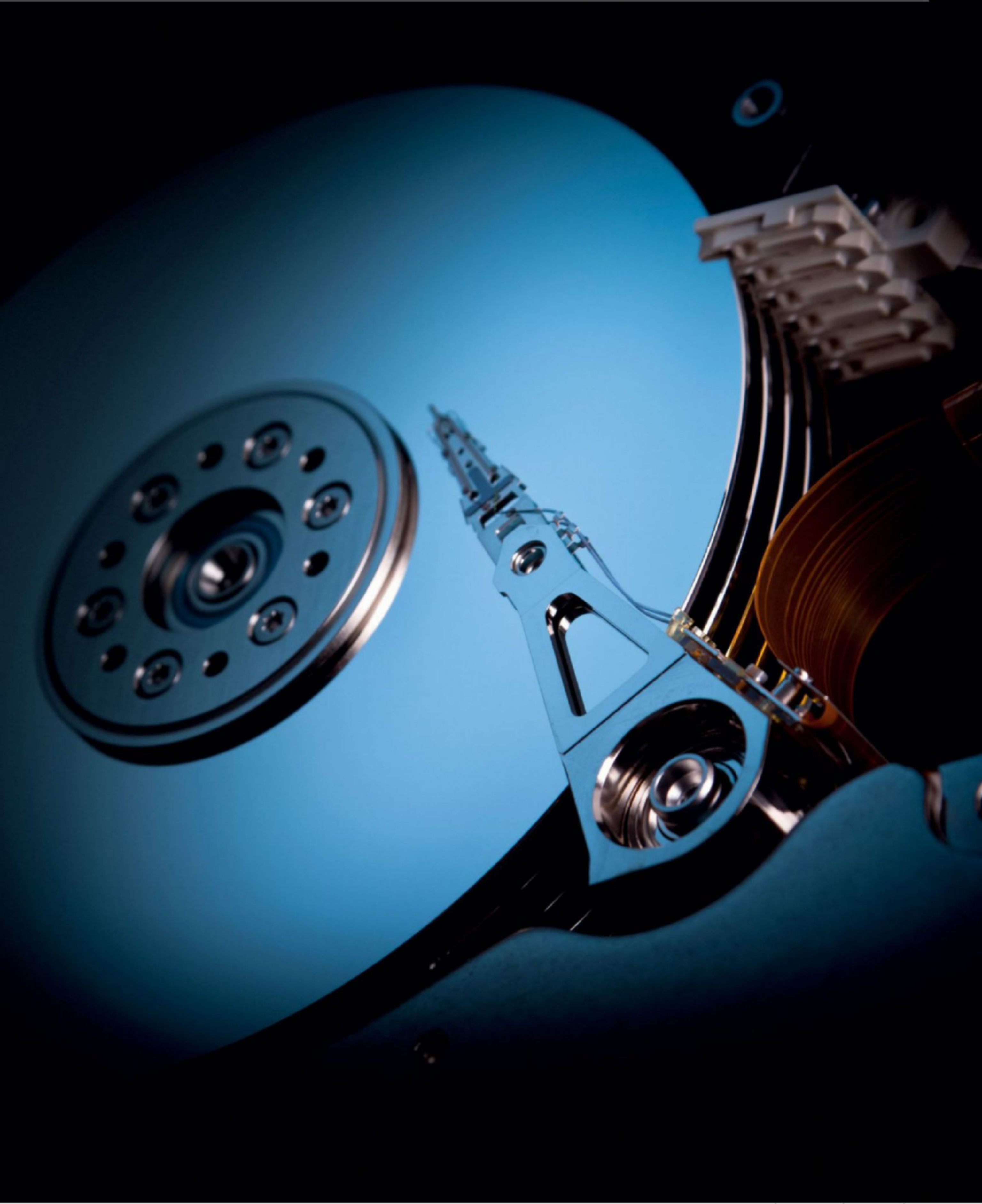
THIS IS A RAID

It's out of the clean rooms and into our homes, but should you be running RAID? And if so, which type? *By Chris Lloyd*

In 1980, IBM's 3380 hard drive cost $81,000 for the 2.5GB model. For the same money, you could walk into your local GM dealer, and buy five Cadillac Eldorados. The huge cost of high-speed storage provided the impetus to develop something that could match these monsters for less—enter the Redundant Array of Inexpensive Disks, RAID's original acronym.

The idea was simple: couple together a number of smaller and cheaper drives to build a larger, faster, and more reliable unit. Data is spread across the disks to introduce a level of redundancy. The concept and the odd patent was knocking about in the '70s, but the first hardware didn't arrive until 1983 (a simple mirrored system from DEC). The term RAID wasn't coined until 1987, and it wasn't until the 1990s that it found favor and started to be used in earnest, before becoming the staple of server rooms. The early systems didn't prove as inexpensive as hoped, either, so the acronym was quietly changed from "Inexpensive" to "Independent."

Hard drives have now become much, much cheaper, and adding RAID to your home rig is well within reach. You'll find software support in Windows and Linux, along with basic hardware support built into most half-decent motherboards. The cost can range from next to nothing, if you have a couple of old drives on the shelf, to $1,000 and upward, if you're after some serious storage. The first question to ask yourself is: Is it worth it? Quickly followed by: What sort of RAID should you employ?



RAID comes in various numbered levels, standardized by the Storage Networking Industry Association. These define the way the data is stored across the disks. Each level has its strengths and weaknesses. So, let's introduce the main contenders currently in widespread use.

RAID Level 0

Data is striped across drives—blocks of data are written in parallel on two or more disks. These disks need to be the same size, although unused space can be used elsewhere with some clever partitioning. As with all levels, the RAID array appears as a single volume. This level is built for speed; in practice, on a typical setup, a two-disk RAID 0 gives you about a 50 percent increase in raw data transfer rates, although access times remain about the same. The size of each data block—the stripe size—affects performance. Options range from 4KB to 128KB. Generally, the larger, the faster, although it increases potential wastage. A smaller stripe size can lead to gains if you have a larger number of disks, or small files. By and large, a compromise somewhere in the middle is best. Adding more disks makes the array faster incrementally, in theory. However, there's a number of other factors that come into play with bandwidth limits and bottlenecks elsewhere in your system, so expect diminishing returns. RAID 0 has no parity or redundancy—if a disk dies, the whole thing is fried, and the more disks you use, the greater that risk. If you place performance above all else, then RAID 0 delivers it simply.

RAID Level 1

This level uses mirroring. Blocks of data are copied to multiple disks at once—generally two, unless you really do expect to be unlucky. These need to be of equal size, and overall capacity is halved. If a drive fails, then you've still got a full copy of the data. So, after you've replaced the failed drive, and copied across the data, you are back to where you started. You can continue to use the array even with one drive down. Performance is pretty much the same as for a single drive, despite any theoretical gains. Read speeds can be increased, but this is down to how the controller and OS work; Windows can struggle to see much difference. RAID 1 is really aimed at data safety done simply.

IBM's 3380 hard drive: an engineering masterpiece, and the size of a refrigerator.

RAID Level 5

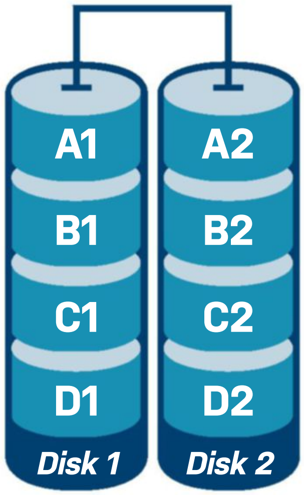
Now it starts to get a little more complicated. This level uses striping, as Level 0, but adds distributed parity into the mix, to allow for a disk failure. Data blocks are striped as RAID 0, and a block of parity data is calculated and written on a separate physical drive. You need a minimum of three disks, and you effectively lose one drive to the parity data. The parity blocks are distributed across the physical drives. If a drive fails, then the data can be rebuilt from the data and parity data. It's worth noting that this is far from quick—it can easily take hours or even days to rebuild an array with modern drives. You still have access to your data, even with one drive down. Data read speeds are good, but the need to calculate the parity drags down write speeds. RAID 5 is a compromise between security and performance. Capacity reduction is less than for a straight mirrored system, and read speeds are better. It doesn't work well with a large number of small random write operations, however. This level used to be recommended for applications where data security was paramount, but times have changed. More on that later.

RAID Level 6

Much like RAID 5, but with double parity. It requires a minimum of four drives. Data is striped to two drives, then the parity data is written to the remaining two drives. No matter how many drives you have, two are effectively lost to parity data. Like RAID 5, the read speeds are good, but write speeds are compromised. The big advantage over RAID 5 is that a RAID 6 system can recover from the loss of two drives at once. You have access to the data, even while a failed drive is being rebuilt, which, like RAID 5, can be

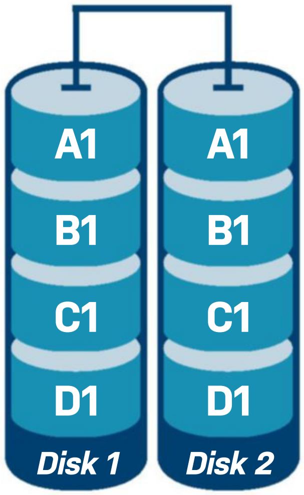
RAID 0

Minimum of two physical drives



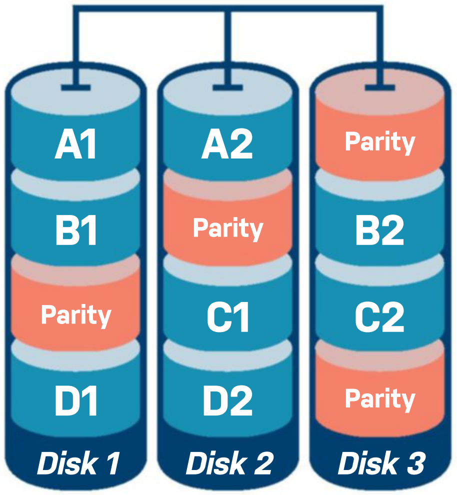
RAID 1

Minimum of two physical drives



RAID 5

Minimum of three physical drives



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The good old days.
Capacities and prices like this prompted the development of RAID systems.

painfully slow. It's the RAID of choice for any system that needs to be up and running at all times, because drives can be swapped out while it's still operating.

RAID Level 10

Also known as RAID 1+0. A nested array, it's effectively a combination of striping and mirroring. It requires a minimum of four drives, divided into two groups. Data is striped across the groups, and mirrored within the group. Capacity is always halved, no matter how many drives you add. RAID 10 can survive the loss of one drive, and without the need to rebuild from parity data, rebuild times are good. A second failure is not always fatal—if it's the mirror of the first failed drive. RAID 10 offers the advantages of RAID 0 speeds, and improved security over RAID 1. It is good with large files and streaming. The biggest drawback is the loss of half the capacity however many drives you add.

More RAIDs

That's not all. There are dozens of non-standard and proprietary levels of RAID. These include other nested variations, such as RAID 5+0 and 1+0+0, and versions limited to certain OSes, filesystems, or specific hardware. However, they are all pretty much variations of the existing levels. RAID 60, for example, stripes data across two RAID 6 groups. It increases performance due to striping, and doubles the number of disks you can lose before a full data loss. However, you need a minimum of eight disks, and you lose half the capacity to parity data. There is also an interesting non-standard array called RAID-1E, which combines mirroring and striping, making a copy of each data block, useful for a three-drive array.

WHICH DO I WANT?

If speed is your thing, RAID 0 is the fastest. Others may come close, but for consistent maximum performance, it is the best. You also get to use all the drive capacity you've bought. The downside is the increased risk. Any unrecoverable sector is just that: gone for good. If any drive in the array fails, you've lost everything—time to format, and start again. The more disks in the array, the higher the chance. It does come into its own when used for very large temporary files, such as those created by image and video editors. You can run these from a fast RAID 0 array safely, because any data loss is easily reconstructed. However, given the

The RAID Levels that Time Forgot

RAID 2 This stripes data across multiple drives, but instead of blocks of data, it stripes at the bit level, complete with Hamming code error correction. High data rates are possible, but it's complex, and requires large arrays of synchronized spinning disks. Now, hard drives have much of the error correction built in, making RAID 2 pretty much redundant.

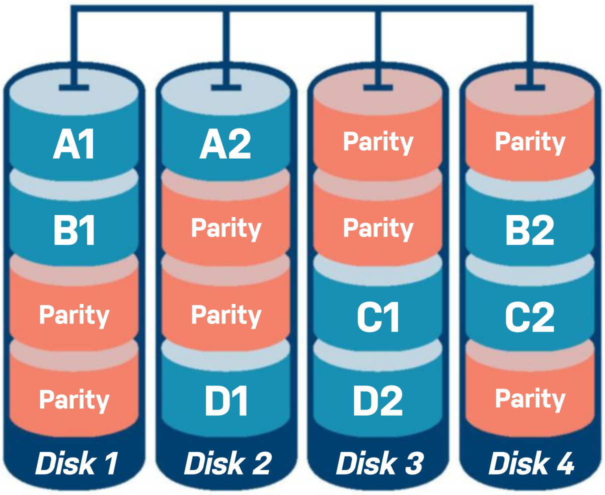
RAID 3 This stripes bits as RAID 2, and writes parity data to a dedicated parity disk. It proved to be not as reliable or cheap as other systems, the single parity disk being a major bottleneck.

RAID 4 Similar to RAID 5, this stripes data at block level, but still puts all the parity on one disk. The large capacities of modern drives mean rebuilding the parity disk after a failure is a long, long job. Best to stick to the distributed parity used in RAID 5 and 6.

RAID 7 A proprietary level of the now defunct Storage Computer Corporation. It turned out to be a variation on RAID 4 with a cache. After unsuccessful attempts to enforce spurious patents on the makers of other parity RAID systems, it all collapsed around the year 2000.

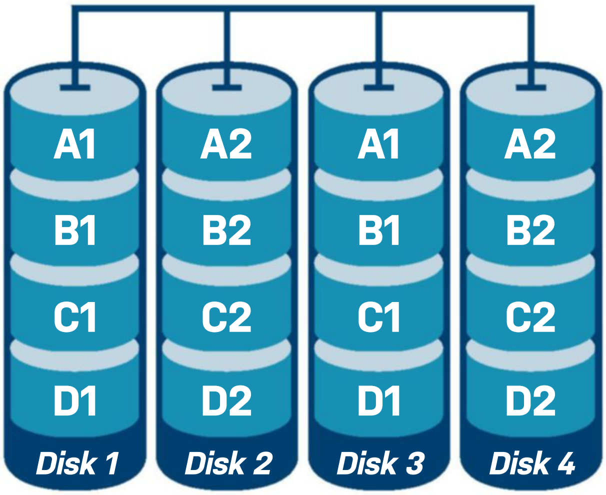
RAID 6

Minimum of four physical drives



RAID 10

Minimum of four physical drives



Non-RAID Options

Sure you want RAID? If it's just speed you're after, a single, large SSD is a better investment. No hard drive RAID 0 system will even get close. Of course, you could always add SSDs to your RAID 0, and go nuts, although SATA 3 limits the fun, unless you move to PCIe-based controllers, including the lovely M.2. True maniacs can go RAID 0 across M.2 slots, making read speeds of 3,000MB/s-plus possible. However, for sheer speed, add SSDs to your existing controllers first.

If you just want to use a motley collection of hard drives more effectively, JBOD—Just a Bunch of Disks—might be a better bet than RAID. There's no redundancy or performance increase, but no capacity loss, either. Your drives are arranged into one logical drive. All you need is a cheap compatible controller card ($30 is plenty). If you simply need more storage, it's cheaper, and can use up mismatched drives. However, if a drive fails, you're in the hands of data recovery tools, because the whole lot goes down.

If data security is paramount, then yes, RAID 6 offers it. However, it is no replacement for a proper backup routine. RAID offers good protection if a drive fails in action, and nothing more. It won't save you from a hack, virus, theft, fire, power spike, or accidental deletion. If you can cope with recovering the data from your last backup after a failure, there's no urgent need for RAID—just get another drive, preferably an external one, make regular backups, and leave it at that.

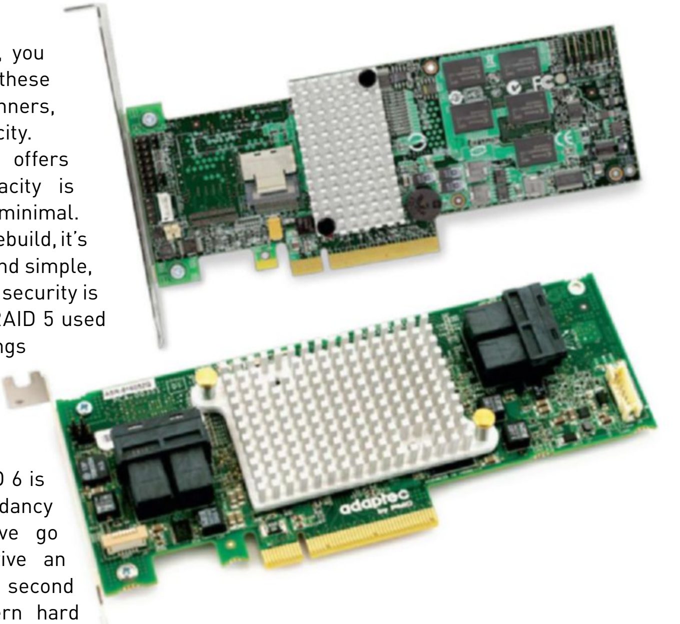
performance of modern SSDs, you are far better off investing in these first, rather than a RAID of spinners, unless you really need the capacity.

RAID 0 too risky? RAID 1 offers simple redundancy, but capacity is halved, and performance gains minimal. If a drive's mirror fails during a rebuild, it's dead. However, RAID 1 is nice and simple, and you only need two drives. If security is important, you can do better. RAID 5 used to be the default choice, but things have moved on. RAID 5 can recover from a drive failure, but it has become increasingly vulnerable to multiple failures.

For good data security, RAID 6 is preferable. That extra redundancy means you can have a drive go down, and it can still survive an unrecoverable data loss on a second drive. Sounds unlikely? Modern hard drives are reliable beasts, but even with a tiny chance of error on any one bit, the cumulative effect makes even a slim chance a real risk when spread over multiple large disks. A typical drive has an Unrecoverable Read Error of 10 to the power of 14; the best can even manage 15. Plug that tiny number into some math, and your chances of failure with a multi-terabyte RAID 5 starts to enter single-digit percentages. RAID 5 no longer offers the levels of security it was designed to give, and can't be recommended. RAID 6 means the loss of a drive to parity data—but think about how catastrophic full data loss would be. Given current drive prices, it's worth losing the capacity to be safe.

That said, RAID 6 is due to hit the same problems as RAID 5 in a few years' time, given the rate at which drives are getting bigger. Triple-parity RAID isn't far away now, although rebuild and data scrubbing times may make it cumbersome in practice. We could soon see the end of traditional parity-based redundancy.

That leaves us with RAID 10, which combines the best bit of RAID 0, the speed, with the best bit of RAID 1, the redundancy. It lacks the data security of parity checking, but is a good compromise between safety and speed. You do lose half the capacity, though. Which do you want? It depends on what you need, but if security is key, it has to be RAID 6. Apart from specialist applications, RAID 10 looks good—drives are cheap enough to stomach the capacity loss for the extra security and speed.



Top: The LSI MegaRAID 9271-4i is a "cost-effective" hardware RAID card.
Below: The Adaptec 71605 is aimed at entry-level servers, and costs around $750.

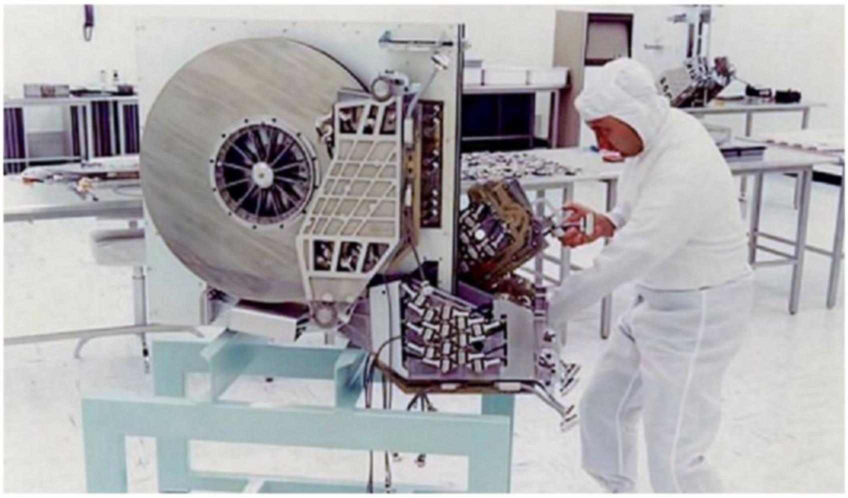
THE HARDWARE

A full-on RAID controller includes a dedicated processor, called ROC (RAID-on-Chip), cache memory, and more. Many consumer motherboards have RAID support, but the abilities and quality vary, because they lack the dedicated hardware, pushing RAID functions over to the rest of the board, the processor, and software. You'll find the motherboard is limited in some ways, only supporting RAID 0, 1, and 5, using whole drives only, no support for hotswapping, and more. Disparagingly called "Fake RAID" by the denizens of server rooms, they are usually much more inflexible than software RAID, without the benefits of a full hardware implementation.

If you're thinking of using your motherboard's controller, read the specifications carefully. These simpler hardware controllers work well enough in a home rig, but it's worth knowing the limitations before you start. If you are going for the security of RAID 6, a more capable controller needs to be in your budget. It can get confusing working out exactly how capable a hardware RAID is, but the price of a controller should be a big clue. If it's tens of dollars, it isn't a full hardware implementation. A "proper" PCIe hardware RAID controller can run into the hundreds.

Running RAID in software sounds like it'll compromise performance, but processors are fast enough now, and if you run without parity, a software RAID can be light on CPU load. Depending on your OS, they can be very flexible, too—Linux take a bow.

SATA or SAS? Depending on your controller, you'll have a choice. Mixing types is frowned upon. SAS drives are sold as "enterprise" drives, and are technically more competent, and theoretically faster. However, benefiting from the extra performance would mean building a



Seriously, you've got it easy nowadays.

serious hardware RAID. SAS drives come in at around $100 for 1TB. Best to go SATA, where $50 buys you 1TB, and $150 gets you 5TB. Don't forget to budget for an enclosure and cables if you plan on a large RAID.

Full hardware RAID systems expect TLER hard drives: Time Limited Error Recovery. If a drive encounters a problem—reallocating a bad block, for example—it can take a few seconds or longer to resolve. However, your RAID controller is likely to notice earlier, and mark the whole drive as having failed. TLER drives take seven seconds to try to fix the problem, then send a warning message to the controller, and defer further attempts. It enables the controller and drive to co-operate more effectively to repair problems. Without it, you might replace good disks needlessly. If the drive has the word "Enterprise" in its name, TLER is enabled. Otherwise, you have to check it's compatible, and turn it on in firmware. If you're running a software or simple hardware RAID, you don't have to worry about TLER.

A simple rule of thumb is to use as many drives as possible. Due to the parallel nature of RAID, the more drives you have, the faster it is. If you are using parity, more drives mean that rebuild times are shorter, as each drive holds less of the parity data. The situation for SSDs is reversed, as the higher capacity drives are faster; although, again, it's worth checking the specifications.

If a drive does go down, you'll probably want a replacement quickly. Best to be prepared, and have an extra drive ready and waiting. Remember: RAID really wants matched drives—not just the same capacity, but identical ones. If you don't have one ready, you might have to compromise, or spend time looking for a decent match.

The HP 462919 offers capabilities comparable to most consumer motherboards.

SHOULD YOU?

Many RAID systems can recover from the loss of a disk; some more than one. Don't let this beguile you into thinking it's a safe place for important data. It isn't a substitute for a proper backup. A power spike can still kill the whole rack. And you have no incremental backup, so if you overwrite an important file, it's gone as effectively as on a failed drive. You're still putting all your eggs in one basket, albeit a more robust one. You still need an effective backup.

Just because you can, it doesn't follow that you should. Hardware RAID can get expensive and complicated fairly quickly. This is a technology that has come down from the server rooms, and can be daunting. Think what you want to achieve and why; RAID might not be the answer. In its simplest form—using Windows 10 Storage Spaces to configure a couple of drives, for example—it is painless enough, but from then on, it can get tricky fast. It's no magic bullet, either—there's no such thing as completely secure storage or fault-free operation. Still interested? Good. Done right, the performance can be intoxicating. Just don't get carried away. ⏻

The Future of RAID

RAID is getting old. As drives get bigger, it struggles to cope. Rebuild times using parity can run into days, and reliability is falling. Really big operations, such as Google, Facebook, and Microsoft, have already moved away from RAID.

There are two approaches to improve things: to build on existing RAID levels, adding triple parity, for example, or to get clever with the math. Enter Rateless Erasure Coding. This uses mathematical functions to define a block of data as a potentially limitless sequence. The math is fiendish, but means your original data can be reconstructed from any subset of the translation equal to or slightly larger than the original—effectively, all the data becomes parity data. You can practically pick your level of redundancy. Want it secure after four failures, or more? It can be done, as can fast repairs after any loss. It's early days, but it is promising. Microsoft uses a version of Erasure Coding in its massive Azure data centers.

More immediately pertinent for home use is the development of new file systems, which have RAID levels of data security and the flexible use of drives built in, rather than added on top.

ZFS (Zettabyte File System), originally from Sun, but now open source, includes many RAID functions, including using checksums, copy-on-write, dynamic striping, and more. It's readily available on Linux systems. Btrfs (B-tree file system), from Oracle, is also available for Linux, and uses copy-on-write at its core. BeyondRAID, from Drobo, offers benefits for a NAS box, although it is proprietary.

Of most interest is Microsoft's ReFS (Resilient File System). It's in Windows Server 2012. It will replace NTFS at some point, though it could be years before it's the Windows standard. It brings many features of RAID right into the filesystem, with integrity checking, copy-on-write, metadata scrubbing, and more. Microsoft boasts that it offers hardware RAID levels of speed and data resiliency, and it has proved pretty capable on Server 2012. You can try it under Win 10 if you use Storage Space to create mirrored drives. So far, though, you can't use it on your boot drive.

Will these kill dedicated hardware RAID? It's doubtful—there will always be a need for ultra-reliable specialist storage, because some data will always be too important to lose, and some servers too important to go down.

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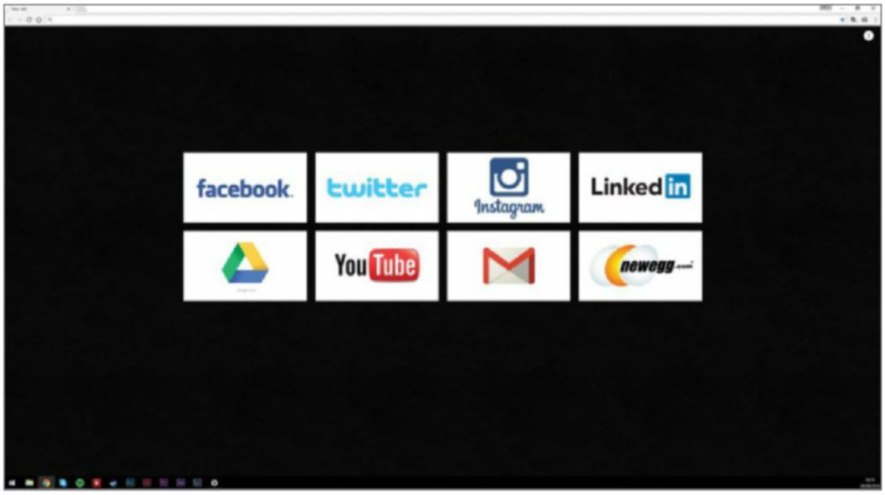
HOW TO

STEP-BY-STEP GUIDES TO IMPROVING YOUR PC

WINDOWS TIP OF THE MONTH



A CLEAN CHROME

We love keeping things neat, so Google Chrome's default new tab page leaves much to be desired. If you want to tidy Chrome up, Speed Dial 2 may be just the extension for you. Head to https://speeddial2.com to install it, then once plugged in, you can add quick links, change the background picture, use custom images, change layouts, monitor usage, even copy entire layouts across multiple systems. Best of all, it's free.

MAKE – USE – CREATE

60
Set up a chat server on your Raspberry Pi

64
Make amazing metal text effects in Photoshop

70
Put together your very own Dream Machine

ZAK STOREY
REVIEWS EDITOR

FAN SPEED AND THE AIO

I'm a massive fan of a silent system. Indeed, recently swapping out from a fully liquid-cooled build at home to a single AIO and aftermarket fan has left me with a particularly noisy rig. The noise is generated by the two fans on the Twin Frozr VI cooling the GTX 1070 at the heart of my machine. But it got me thinking: How important is fan speed when it comes to cooling?

Well, the answer varies depending on whether you're utilizing an air tower or an AIO liquid cooler. With a traditional tower, fan speed matters. As the coolant within the heat pipes draws heat away from the processor and evaporates inside, it then requires the fan to push vast quantities of cool air over the heatsink to condense it back down into liquid, to fall back down and continue the process. AIOs, however, operate differently. The quantity of coolant is vastly increased, and pump speed is the more important factor when it comes to moving that heat to the radiator. Increasing fan speed here does little more than ensure the overall capacity of the radiator isn't overcome by excess heat. The smaller the radiator, the greater the fan speed necessary to circumvent the excess heat.

If you're after a quieter system, the best solution would be to go with an AIO liquid cooler, or custom loop with low-speed fans (we're talking sub-1,000rpm). As long as air is moving in and around your chassis, temperature-wise you'll be fine.

↘ submit your How To project idea to: comments@maximumpc.com

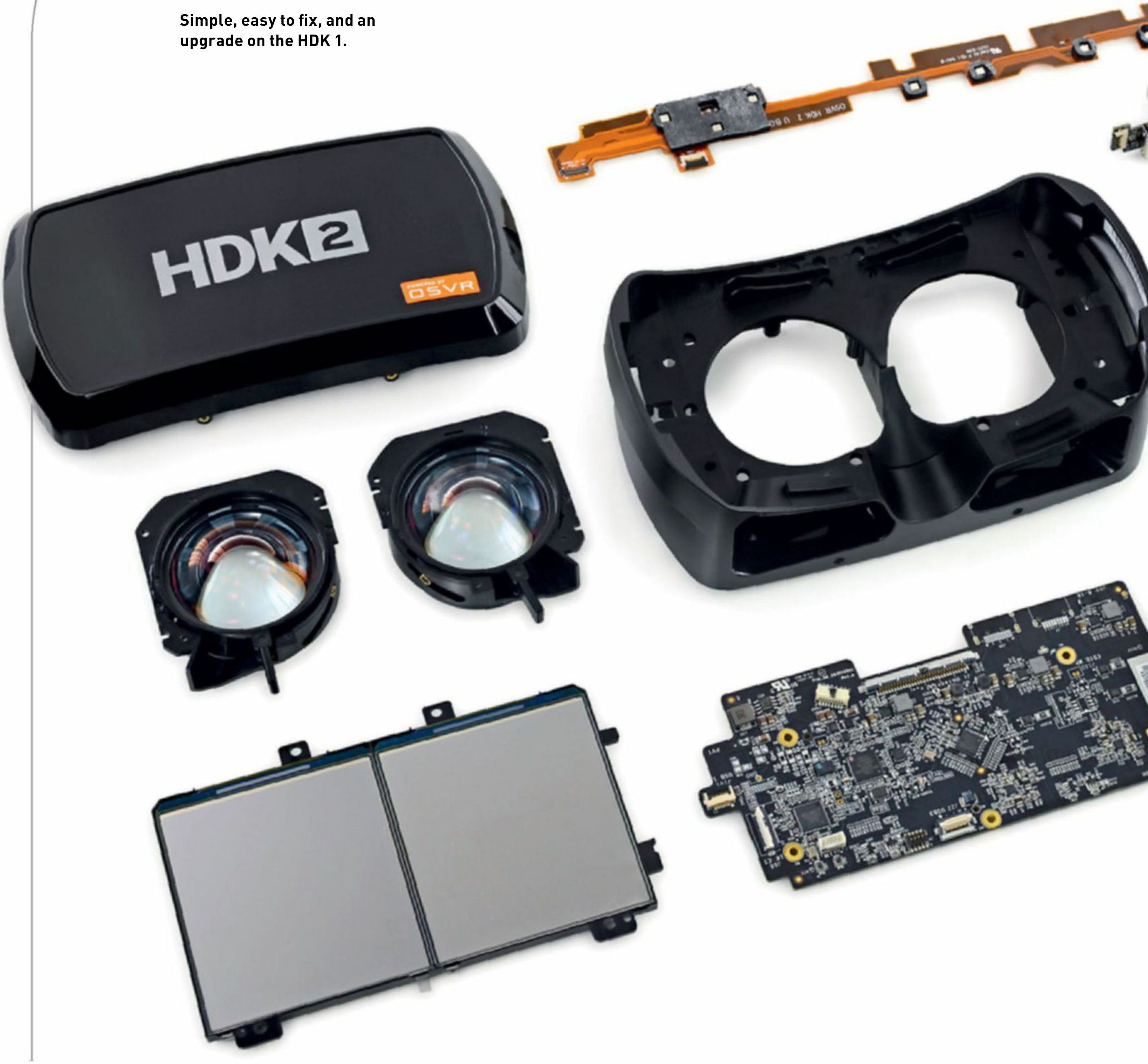
IFIXIT presents:

AUTOPSY

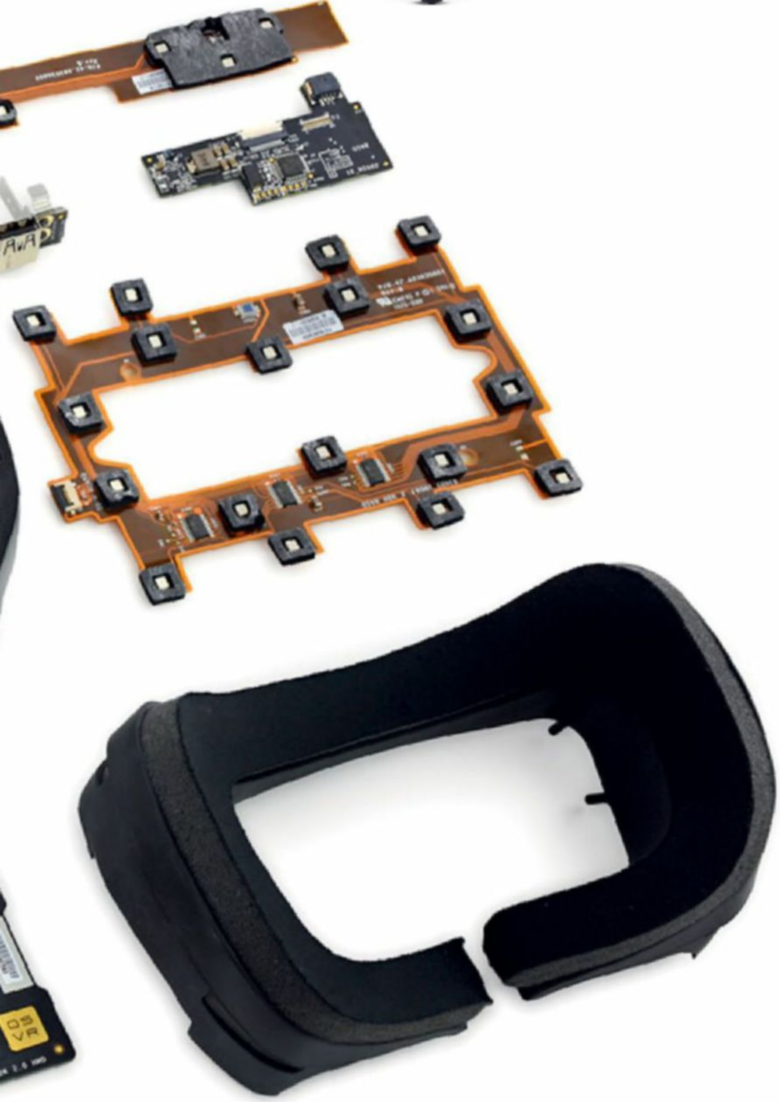
THIS MONTH WE DISSECT...

Razer OSVR HDK 2

Simple, easy to fix, and an upgrade on the HDK 1.


HDK 2
OSVR
OSVR HDK 2

These IR sensing cameras should give the Vive a run for its money.



BACKGROUND

The VR world is packed with serious contenders. The newest hardware and software solution comes from a dynamic duo: Razer, gaming peripherals giant, and Sensics, virtual reality maven. Their offering: the OSVR HDK 2. Can it hang with the platform heavyweights? We'll find out soon enough!

MAJOR TECH SPECS

- Head-mounted display (HMD) with dual OLED displays, 2160x1200 combined resolution (441 ppi), 90Hz refresh rate
- IR camera with 360-degree tracking, operating at 100Hz
- Belt box with surround-sound audio codec, along with "signal boosters"

KEY FINDINGS

- Time to hunt for those hidden IR LEDs. Because the HDK 2 is built to be accessible to developers, we aren't surprised to learn the headset's gatekeepers are friendly Phillips screws. But with the screws removed, the faceplate seems to be held in place by some mystical energy field (magnets).
- This motherboard's easy access is a teardown engineer's dream... Until we realize it's held hostage by two sneaky flex cables snaking down to the displays. Many components are accessible without having to remove the motherboard, so hopefully most users won't need to go this far.
- After removing four Phillips screws, the display assembly lifts out of the headset with ease. A smear of light adhesive attaches each of the screens to the plastic casing.
- Not all lenses are created equal. While the HTC Vive and Oculus Rift both offer adjustments for IPD (inter-pupillary distance), the OSVR does not. While the OSVR lacks IPD adjustment, it does boast one claim over the competition—those knobs allow independent eye relief adjustment. Anisometropia sufferers rejoice! Focus adjustments range from +4.5 to -2 diopters, which should allow most (but not all) regular optical-enhancers to ditch their spectacles while using the OSVR.
- Repairability Score: 9 out of 10 (10 is easiest to repair). Standard Phillips screws hold the headset and its components together. The motherboard is easily accessible after removing the cover. The cables and foam facepad are sturdy and detach easily. However, reconnecting the motherboard to the two display data cables underneath is tricky. The two OLED screens are attached to the case with adhesive that requires some prying to detach. ⏻

An upgrade in resolution helps keep the screen density at an impressive 441 ppi.

About iFixit

iFixit is a global community of tinkerers dedicated to helping people fix things through free online repair manuals and teardowns. iFixit believes that everyone has the right to maintain and repair their own products. To learn more, visit www.ifixit.com.

Set Up a Chat Server on Your Raspberry Pi

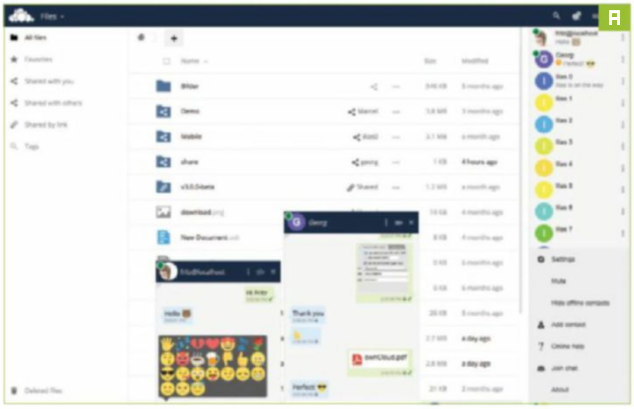
YOU'LL NEED THIS

RASPBERRY PI
See www.raspberrypi.org.

MESSAGING CLIENT
We're using Pidgin, available from www.pidgin.im.

WITH FACEBOOK CHAT, GOOGLE HANGOUTS, Yahoo Messenger, and ICQ, to name but a few, there's certainly no shortage of chat services available nowadays. The downside of all these offerings is that they're closed-source, meaning the code used to design them is not released to the public. This makes it harder to detect security vulnerabilities—plus, you have to trust that big corporates are keeping your private conversations safe.

Federation is also definitely not supported by most proprietary chat software—for instance, someone using the official Google Hangouts app has no way of speaking directly to someone using AOL Messenger. So, how can you get around all these problems? Read on.... **–NATE DRAKE**



1 XMPP TO THE RESCUE

The solution to all of the above is XMPP (Extensible Messaging and Presence Protocol). XMPP is a communications protocol for open-source and secure messaging. Unlike chat software created by big corporations, there's a number of programs you can use to connect to a server running XMPP, and you don't have to share the contents of your conversation with anyone except your contacts.

›› There are thousands of public XMPP servers, some run by large companies and others by private individuals. The Raspberry Pi can easily be used to set up your own XMPP server, to allow your friends, co-workers, or family members to connect and chat together.

›› Part of this project was adapted from a guide put together by Tomas Greno, which can be viewed at http://bit.ly/2dal1Z7.

2 WHY XMPP?

Before starting this project, you may be wondering why you would even want to set up your own chat server on your Raspberry Pi, given the number of alternatives available. You may also be questioning why you would choose XMPP, when you could use more familiar software, such as Facebook Messenger, or have your contacts meet you in an online chatroom. For a full technical rundown of the technologies underlying XMPP, you can visit the Overview page of the XMPP Foundation at http://bit.ly/2d7XrHV. However, in brief, one of the chief advantages of using XMPP to host your own chat server is security—your messages will never leave the server. So, provided your Raspberry Pi never leaves your home or office, it will be much more difficult for someone to read your chat history.

›› Even if you allow others to connect to your Pi chat server over the Internet, you will be using open-source software, which is regularly reviewed by a community of developers, rather than by one team at a single company. This means there is a far greater chance of vulnerabilities being discovered and fixed.

›› XMPP is also extremely flexible. Any XMPP server that is connected to the Internet can communicate with any other user registered with another XMPP server.

›› For example, if you register a chat account with the popular German XMPP server www.jabber.de, you can still communicate with someone who has an account with the British XMPP server www.xmpp.is. Usernames are written in the style of email addresses, such as "hansgruber@jabber.de," and you can add them as contacts in your messaging app [**Image A**].

›› There's a great many XMPP messaging programs available for both computers and mobile devices. Apple's Messages for Mac OS X, and the program Empathy, which comes preinstalled with many versions of Linux, both support the XMPP protocol. For Windows users, it's very easy to download a compatible client.

3 CHOOSE YOUR MESSAGING CLIENT

To connect to your Pi's server, we will be using Pidgin [**Image B**], because it's very flexible and is available for Windows, Mac, and Linux. If you're a Mac or Windows user, head over to www.pidgin.im/download to download Pidgin Messenger. If you're using Linux, simply install it using your OS's package management tool.

›› Although when following the tutorial you will already have added an admin account, this shouldn't be for daily use, so we will create a new account when starting Pidgin.

›› When the Pidgin window opens, select "XMPP" under "Protocol." As we're creating a new account, the username can be anything you want. In the "Domain" field, put the IP address or domain name of your Raspberry Pi, such as "192.168.1.2." The password field can contain any value you like. It's a good idea at this stage to check the "Remember Password" box, to save having to log in each time.

›› The "Local Alias" field is simply the name you wish to appear on your own version of Pidgin, to help you distinguish your account—for example, "Roger-Raspberry-Pi." Check "Create a New Account on this Server," then click "Add."

›› Pidgin is not available for Android devices or iPhones. You can view a full list of XMPP clients for all platforms at http://bit.ly/2d1o2b1. Free apps for iPhone include ChatSecure (see below) and AstraChat. Both are available from the iTunes Store. Cost-free Android XMPP apps include ChatSecure for Android and Beem, both of which are available in the Google Play Store.

4

PIDGIN PLUGINS

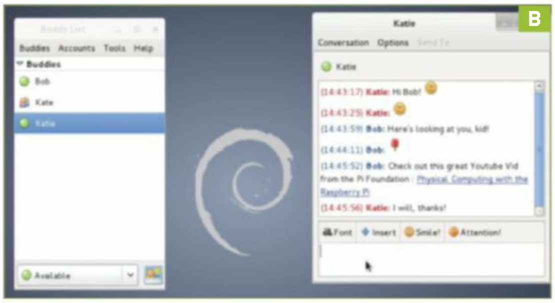
As you will have seen when setting it up, Pidgin supports a number of protocols, such as AOL Instant Messenger, Google Talk, and Yahoo Messenger. It's also highly customizable through the use of extra plugins [**Image C**]. Some of these plugins, such as Theme Manager, are official, and accessed by clicking the "Tools" menu in Pidgin, then "Plugins." Other plugins have been developed by third parties. A full list of third-party plugins, as well as instructions for installation, is available from http://bit.ly/2cof2P1. One particular plugin of note is Off-the-Record Messaging (OTR).

» In brief, if this plugin is installed in both your copy of Pidgin and that of your friends or colleagues, your conversations are automatically encrypted. Unlike the SSL certificate, which is stored on the Pi, OTR encryption keys never leave your computer, so even the chat server can't keep a meaningful copy of your transcripts.

» If you want to access the chat server securely from a mobile device, try ChatSecure. This free app is available for Android and iPhone, and supports OTR messaging without needing to install extra plugins. More information is available from the Guardian Project's website at http://bit.ly/2cJti6A.

» If you are considering opening your Pi chat server to the Internet, another useful plugin is Bot Sentry. This prevents you from being overwhelmed with spam messages, because you only receive messages from people on your buddy list.

» Once Pidgin is secure, you may want to tweak its appearance, so head over to www.pidginthemes.com.



(14:43:17) **Katie:** Hi Bob!

(14:43:25) **Katie:**

(14:43:59) **Bob:** Here's looking at you, kid!

(14:44:11) **Bob:**

(14:45:52) **Bob:** Check out this great Youtube Vid from the Pi Foundation : Physical Computing with the Raspberry Pi

(14:45:56) **Katie:** I will, thanks!

5

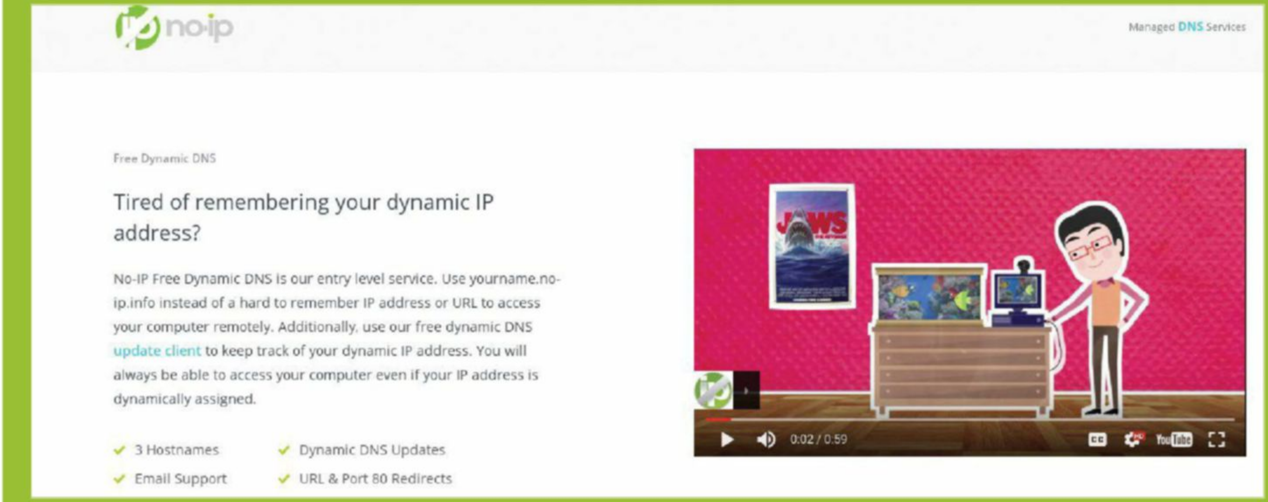
CHAT CHALLENGES

As you'll see in the walkthrough (on page 63), the software is very simple to set up and run. If you are having trouble installing the software in the first place, you should make sure you have the latest version of Raspbian. Open Terminal on the Raspberry Pi, or connect via SSH, and run the command `sudo apt-get update` then `sudo apt-get upgrade`. The second command may take some time, so make sure you don't need to use your Raspberry Pi urgently before running.

» As you're going through the walkthrough, you may have difficulty finding the sections you have to edit in the configuration file. Use Ctrl-W to run a search within the file for the sections you need to change—for example, "VirtualHost." Just type your search term and press Return to be taken to the word in question.

» If you restart the Pi for any reason, the Prosody chat service stops. You can get it running again by opening

OPENING YOUR CHATS TO THE WORLD WIDE WEB



Free Dynamic DNS

Tired of remembering your dynamic IP address?

No-IP Free Dynamic DNS is our entry level service. Use yourname.no-ip.info instead of a hard to remember IP address or URL to access your computer remotely. Additionally, use our free dynamic DNS update client to keep track of your dynamic IP address. You will always be able to access your computer even if your IP address is dynamically assigned.

- ✓ 3 Hostnames
- ✓ Email Support
- ✓ Dynamic DNS Updates
- ✓ URL & Port 80 Redirects

By default, your chat server will run on your home network only. If you want to communicate with people within your own home or workplace, there's no need to open your Pi to the world.

If you think it would be useful to be able to access the chat server from outside your home or office, first set a static IP address for your Pi, if you haven't already, by following the guide at http://bit.ly/2cCHl8F. Next, you need to obtain a fixed IP address for your router. Your ISP may be able to do this for you for a fee. Alternatively, you can create a hostname that points to your home router through a service such as www.noip.com free of charge. The next step is to open ports 5222 and 5269 on your router. These are the default ports used by XMPP. You need to do this from your router's configuration page. As the steps are different for each router, we cannot provide instructions here, but you can find information on how to forward ports for most common routers at www.portforward.com.

If you do set up a new domain name or IP address for the Pi, be sure to follow Step 2 of the walkthrough (on page 63), to update the domain name/IP in the "Virtual Hosts" section.

Because people will be connecting over the Internet, you may also want to secure your connection with an SSL certificate. (See "Securing Your Chats" box, over the page.)

C
pidgin
Login | Help/Guide | About Trac | My Notifications | Register | Preferences
DOWNLOAD
PLUGINS
HELP
ABOUT
NEWS
DEVELOPMENT
Wiki
Timeline
Roadmap
View Tickets
View Reports
Search
API
wiki: ThirdPartyPlugins
Start Page
Index
History
Watch Page

Plugins

1. Installing Plugins
    1. Windows
    2. Unix/Linux
2. Official Plugins
3. Third-Party Plugins
    1. Additional Protocols
    2. Security and Privacy
    3. Notifications
    4. Profile and status updates
        1. 'now playing' plugins
    5. Interface tweaks
    6. Accounts and logs
    7. Miscellaneous
4. Development of Third-Party Plugins

Installing Plugins

Terminal on the Pi or connecting via SSH and running the command `sudo /etc/init.d/prosody start`.

6 MORE TROUBLESHOOTING

If you find the software fails to start, try running the command `sudo luac -p prosody.cfg.lua` to check the configuration file. If all is well, the Terminal simply goes on to the next line when you press Return. Otherwise, it tells you the line where there is an error message.

» If you choose to enable SSL, modify the location of both the KEY and CRT file. If you used the Prosody software to generate a self-signed certificate, this is in the same folder. Some messaging clients may display a warning before connecting. This isn't in itself a cause for concern, but it may prevent certain programs from being able to connect.

» If you choose only to access the server from your home or office network, remember that your conversations are only secure if no one can physically access your Raspberry Pi. If you don't use OTR messaging, anyone connected to the network may also be able to read your messages by viewing network traffic. See https://prosody.im/doc/security for a detailed rundown of possible vulnerabilities, as well as suggestions on how to solve them. If you do use OTR messaging, bear in mind that chatrooms are not currently supported.

7 VIDEO ISSUES

Voice and video calls are supported by an extension to the XMPP protocol known as Jingle. Not all XMPP clients support this feature. For instance, voice and video calls are only available from the Apple Mac and Linux versions of Pidgin. Linux's built-in messenger, Empathy, also supports Jingle out of the box, as does Jitsi, which is available for Linux, Mac, and Windows. If your contacts only use Windows, they can download a different client, such as Psi (available from http://psi-im.org), which may support video calling. Alternatively, Windows 10 users can install the Linux version of Pidgin via the Windows 10 Bash shell. See http://bit.ly/1N3Ob2f for details.

» If you have a number of users performing large file transfers or video calling, you may notice the chat server starts responding more slowly. You can relieve this, at least in part, by enabling data compression on your server. See the steps outlined at http://bit.ly/2cPVIJI for more information. Compression is set on a sliding scale from 1 to 9, where 9 is the highest, but uses the most system resources, which in turn could actually slow the Pi down further. We suggest you start at 7, as the Prosody website suggests, and increase as necessary.

ANOTHER PI TUTORIAL NEXT MONTH

8 SHARE THE LOVE

Although XMPP software is very robust and powerful, you may find that some people are reluctant to join your server because they are more familiar with chat services such as Facebook or Google Hangouts, and/or they know how to use those clients. The best remedy is to provide your contacts with some information on the protocol, and what it can do for them. A good place to start is the XMPP Foundation's wiki at http://bit.ly/2clH7ld.

» If you do persuade people to use your chat server, you may want to set up a dedicated chatroom for everyone. You need to specify this in your configuration file. Visit http://bit.ly/2ctr9ZL for details of how to do this.

» Prosody is extremely lightweight, which makes it ideal for running on the Raspberry Pi. The downside to this is that you may need special features that aren't available. One example would be the ability to broadcast a message to everyone who is online, which isn't natively supported. Fortunately, there is a large number of add-ons for Prosody, known as modules. Head over to https://modules.prosody.im to see a list of those available. If you see any you think would be useful, download them to your Pi, and follow the steps at http://bit.ly/2ctqpne to install them. You may need to restart the Raspberry Pi for the module(s) to take effect. ⏻

SECURING YOUR CHATS

If you want to be sure your connection is safe, you can use an SSL certificate to encrypt the connection each time your messaging client passes the password to the Raspberry Pi.

If you wish to connect your Pi's chat server to the Internet, it's best to obtain your certificate from a legitimate certificate authority. This also makes it easier for your chat server to authenticate itself to other XMPP chat servers over the Internet.

Alternatively, you can generate your own self-signed certificate. This is generally considered less secure, and some XMPP messaging programs may refuse to connect to it, but it's easier to set up. First, open Terminal on the Pi, or connect via SSH, and run the command:

```
sudo prosodyctl cert generate
yourhostname
```

For example:

```
sudo prosodyctl cert generate
192.168.1.2
```

You are asked a series of questions, such as your key size, country, and so on. Press Return to accept the default options, except when you're asked for the "Common Name." Here, type your chat server's IP address—"192.168.1.2," for example. When done, the system tells you where it has stored the CRT file. Make a note of this. Next, open the Prosody configuration file with the command:

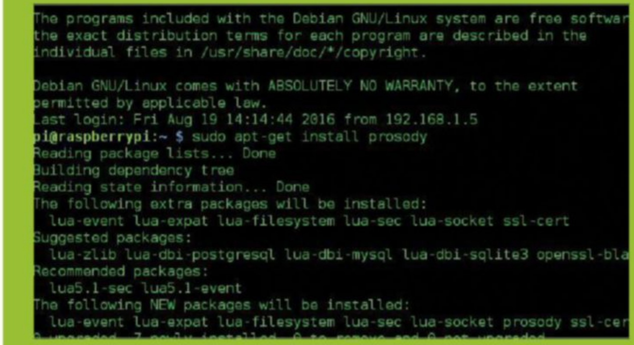
```
sudo nano /etc/prosody/prosody.cfg.lua
```

Scroll down to the section marked `ssl =` and edit with the correct path to your files, such as:

```
ssl = {
  key = "/var/lib/prosody/
192.168.1.2.key";
  certificate = "/var/lib/prosody/
192.168.1.2.crt";
}
```

Press Ctrl-X, then Y, then hit Return to save your changes.

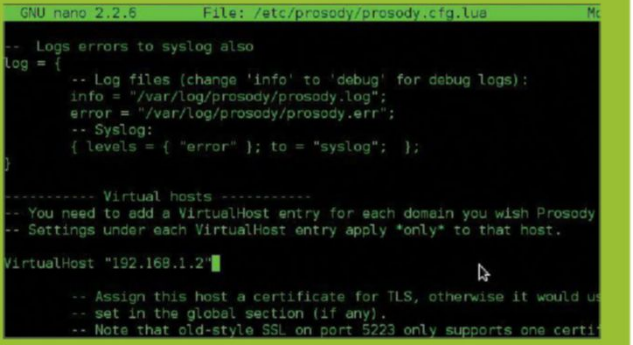
SET UP YOUR CHAT SERVER



```
The programs included with the Debian GNU/Linux system are free softwar
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Fri Aug 19 14:14:44 2016 from 192.168.1.5
pi@raspberrypi:~ $ sudo apt-get install prosody
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following extra packages will be installed:
  lua-event lua-expat lua-filesystem lua-sec lua-socket ssl-cert
Suggested packages:
  lua-zlib lua-dbi-postgresql lua-dbi-mysql lua-dbi-sqlite3 openssl-bla
Recommended packages:
  lua5.1-sec lua5.1-event
The following NEW packages will be installed:
  lua-event lua-expat lua-filesystem lua-sec lua-socket prosody ssl-cer
```

1. INSTALL PROSODY

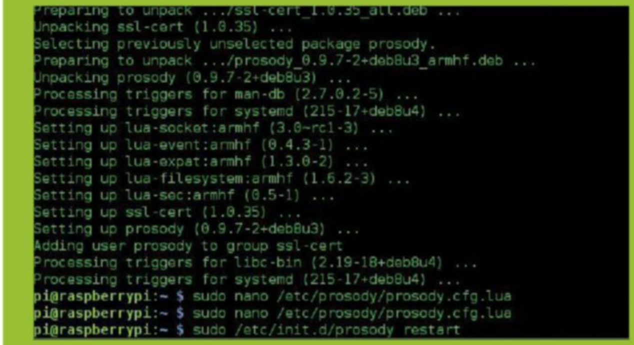
Open Terminal on your Raspberry Pi, or connect via SSH, and run the command `sudo apt-get install prosody`, then press Y to confirm you want to install the software on your device. In the next step, you'll need to change your configuration, so run `sudo nano /etc/prosody/prosody.cfg.lua`.



```
  GNU nano 2.2.6          File: /etc/prosody/prosody.cfg.lua                 Mo

--  Logs errors to syslog also
log = {
        -- Log files (change 'info' to 'debug' for debug logs):
        info = "/var/log/prosody/prosody.log";
        error = "/var/log/prosody/prosody.err";
        -- Syslog:
        { levels = { "error" }; to = "syslog";  };
}

----------- Virtual hosts -----------
-- You need to add a VirtualHost entry for each domain you wish Prosody
-- Settings under each VirtualHost entry apply *only* to that host.

VirtualHost "192.168.1.2"

        -- Assign this host a certificate for TLS, otherwise it would us
        -- set in the global section (if any).
        -- Note that old-style SSL on port 5223 only supports one certi
```

2. MODIFY CONFIG FILE

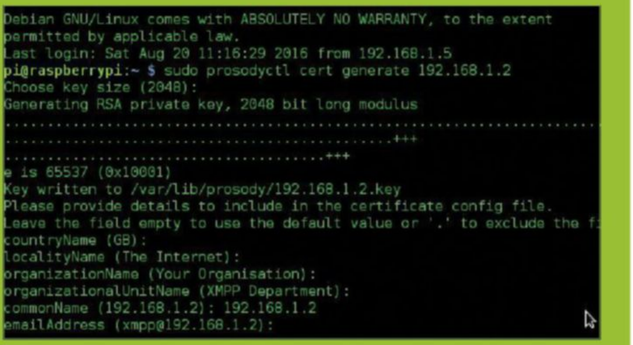
Scroll to the section labeled "Virtual Hosts" and change `example.com` to your domain—for example, `192.168.1.2`. Scroll up to the section named "Server Wide Settings" and, under "Admins," change, to `admins = {"admin@yourip"}` — for example, `admins = {"admin@192.168.1.2"}`. Next, search for the words "allow_registration" and change to `true`. Press Ctrl-X, Y, then Return to save and exit.



```
Preparing to unpack .../ssl-cert_1.0.35_all.deb ...
Unpacking ssl-cert (1.0.35) ...
Selecting previously unselected package prosody.
Preparing to unpack .../prosody_0.9.7-2+deb8u3_armhf.deb ...
Unpacking prosody (0.9.7-2+deb8u3) ...
Processing triggers for man-db (2.7.0.2-5) ...
Processing triggers for systemd (215-17+deb8u4) ...
Setting up lua-socket:armhf (3.0~rc1-3) ...
Setting up lua-event:armhf (0.4.3-1) ...
Setting up lua-expat:armhf (1.3.0-2) ...
Setting up lua-filesystem:armhf (1.6.2-3) ...
Setting up lua-sec:armhf (0.5-1) ...
Setting up ssl-cert (1.0.35) ...
Setting up prosody (0.9.7-2+deb8u3) ...
Adding user prosody to group ssl-cert
Processing triggers for libc-bin (2.19-18+deb8u4) ...
Processing triggers for systemd (215-17+deb8u4) ...
pi@raspberrypi:~ $ sudo nano /etc/prosody/prosody.cfg.lua
pi@raspberrypi:~ $ sudo nano /etc/prosody/prosody.cfg.lua
pi@raspberrypi:~ $ sudo /etc/init.d/prosody restart
```

3. RESTART AND ADD AN ADMINISTRATOR

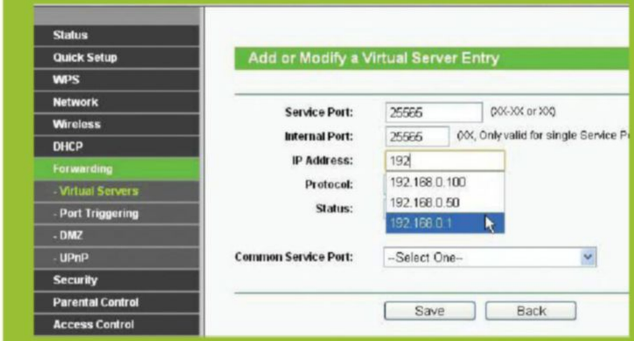
Run the command `sudo /etc/init.d/prosody restart` to restart Prosody. Next, add an administrator account with the command `sudo prosodyctl adduser admin@yourdomain`—for example, `sudo prosodyctl adduser admin@192.168.1.2`. You're asked to type an administrator password. Do so, and press Return. Retype the password, then press Return once again.



```
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Sat Aug 20 11:16:29 2016 from 192.168.1.5
pi@raspberrypi:~ $ sudo prosodyctl cert generate 192.168.1.2
Choose key size (2048):
Generating RSA private key, 2048 bit long modulus
.........................................................................
..............................................+++
.........................................+++
e is 65537 (0x10001)
Key written to /var/lib/prosody/192.168.1.2.key
Please provide details to include in the certificate config file.
Leave the field empty to use the default value or '.' to exclude the f
countryName (GB):
localityName (The Internet):
organizationName (Your Organisation):
organizationalUnitName (XMPP Department):
commonName (192.168.1.2): 192.168.1.2
emailAddress (xmpp@192.168.1.2):
```

4. GENERATE AN SSL CERTIFICATE

This step is optional, but recommended. At this stage, you may wish to generate an SSL certificate to allow messaging clients to connect securely to your server. Follow the steps in "Securing Your Chats" (opposite) to do this.



Add or Modify a Virtual Server Entry

Service Port: 25565 (XX-XX or XX)

Internal Port: 25565 (XX, Only valid for single Service P

IP Address: 192

192.168.0.100

192.168.0.50

192.168.0.1

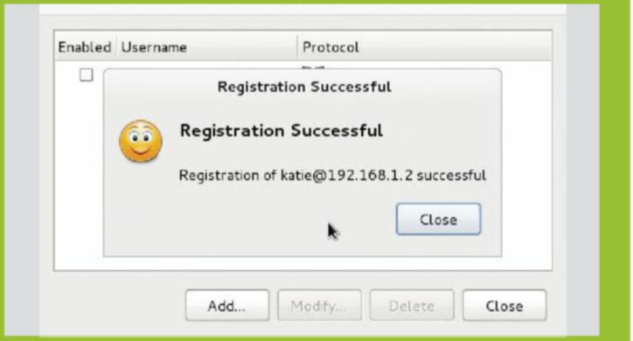
Protocol:

Status:

Common Service Port: --Select One--

5. MAKE IT ACCESSIBLE OVER THE INTERNET

If you only want to use the chat server in your home or office, this step isn't necessary. However, if you want to be able to chat to people in the world at large, follow the steps outlined in "Opening Your Chats to the World Wide Web" (see page 61).



Registration Successful

Registration Successful

Registration of katie@192.168.1.2 successful

6. CONNECT WITH AN XMPP CLIENT

Finally, use Pidgin, or another XMPP-compatible program, to connect to your chat server. Provide the details to your friends or co-workers to make sure that they can connect, too. And that's it—you're ready to chat away to your heart's content.

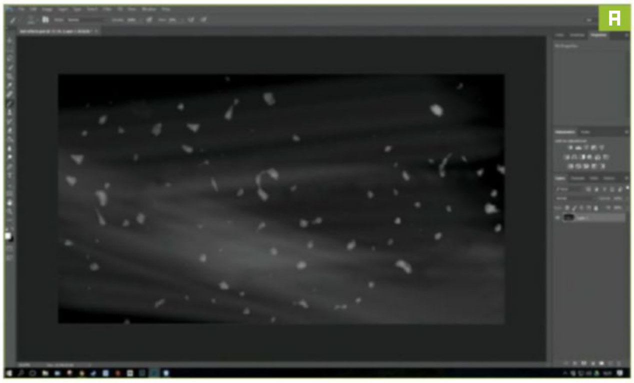
Make Metal Text Effects in Photoshop

YOU'LL NEED THIS

PHOTOSHOP
Subscribe at www.adobe.com.

TEXT ISN'T ALWAYS SOMETHING YOU'D THINK OF when using Photoshop, with many designers preferring to set it in InDesign or Illustrator instead, for more control over tracking, leading, and the arcane secrets of the typographer's art. For eye-catching words or single lines, however, Photoshop does a perfectly acceptable job, with the advantage that you can use it to create colorful effects that make it leap off the page, or sink into a block of metal, as we'll recreate here.

The Type tool is the T-shaped icon in the toolbar, which folds out to reveal four options. There's the basic Horizontal Type tool, which we'll be using here, and a Vertical Type tool, which does what you'd expect, plus horizontal and vertical versions of the Type Mask tool, which puts you in something like Quick Mask mode as you type, and with a click of a button leaves you with selection outlines of your type, rather than actual letters. –IAN EVENDEN



1 CREATE A BACKGROUND

We're going to need a suitably grungy background for our text to sit on, so start with a new, blank document at the size of your choice (we've gone with 4096x2160), and fill it with black. Then choose one of the brushes near the bottom of Photoshop's built-in set—the ones that look as though you're painting with a texture—and make it a few hundred pixels across. Paint white across your black background with low opacity settings, until you've got something you're happy with, then choose the circular texture brush—the very last one in the default palette—and expand it to the width of your image (maximum 5,000 pixels). Paint white again, but this time with high opacity, and only click once or twice, so you get a pattern of dots [Image A].

2 ADD CORROSION

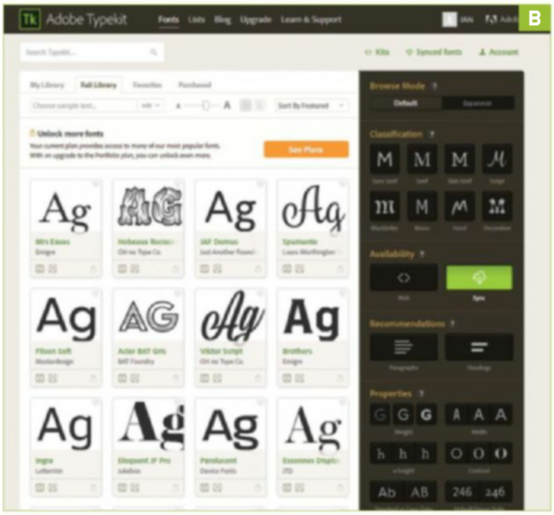
Head over to the Filter Gallery and apply Chrome from the Sketch set. Mess with the settings, and you'll get something that looks vaguely like metal, with the white dots you painted becoming depressions in the surface. If the result is a bit bright for your tastes, increase the contrast with "Image → Adjustments → Brightness/Contrast" to darken the darker areas. If you're lucky enough to have an old car decaying in your backyard, you can skip this step by heading out with your camera and taking a picture of its corroding metal yourself.

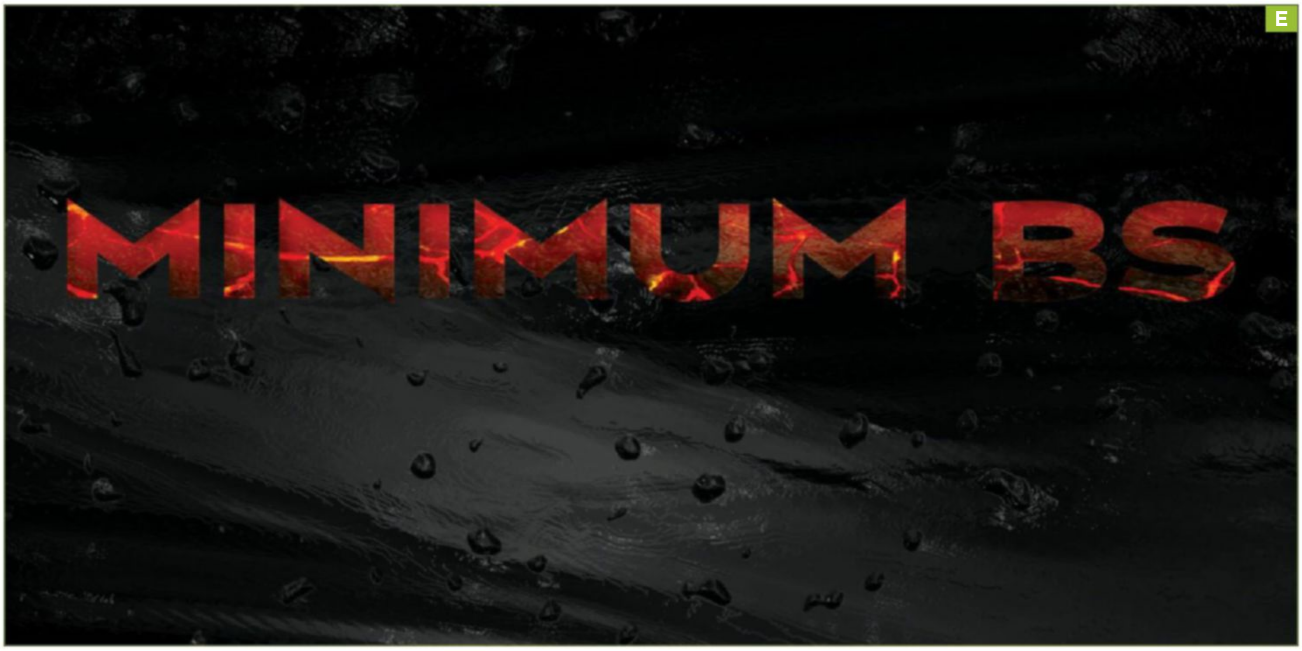
3 FIND A FONT

On to the text. The choice of font is important here, because no one wants to see Comic Sans. Adobe bundles fonts with every Creative Cloud subscription through its TypeKit service, so if you don't like what you've got installed, click "Add Fonts From TypeKit" on the Font menu drop-down to be taken to Adobe's website [Image B], from where you can browse and sync new fonts to your PC. They're added to Photoshop's Font menu without a restart. Type your text.

4 ADD SOME EFFECTS

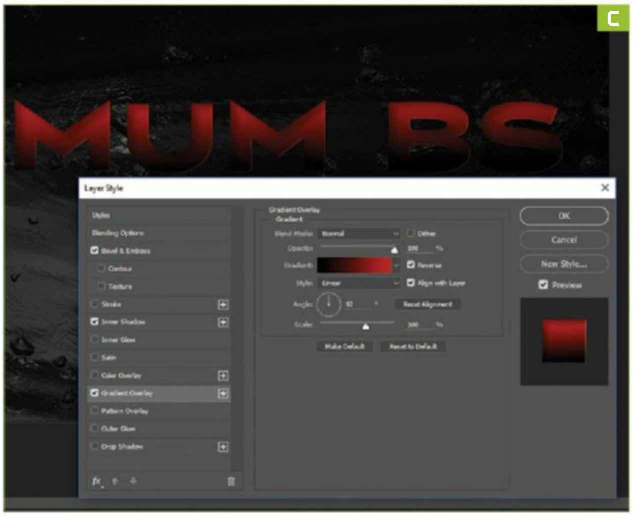
Right-click the text layer in the Layers palette and select "Blending Options." This opens the Layer Styles window, and enables us to add effects to the type [Image C]. Check the boxes of the effects you want to use in the left-hand column, but beware that checking a box doesn't mean the controls in the window are affecting that effect. For this, you have to make sure you've clicked the name. We used Bevel and Emboss, and Inner Shadow. Play around with the settings until you've got something that you like the look of. For the color effect, add a Gradient Overlay, with red at the top and black at the bottom, using the direction wheel in the options to change the direction of the blend. Then hit "OK." One of the best things about Photoshop's text layers is that they're not rendered until you flatten the image or specifically request it, so you can go back to tweak the settings at any time by double-clicking the layer in the Layers palette.




E
MINIMUM BS

5 LAVA UP

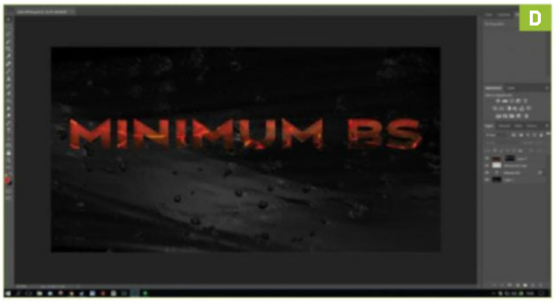
Other, lesser, magazines might have stopped there, but there are a few things we can do to make our text even more awesome. Adding a texture is one of them, and what could be more appropriate for our metal effect background than molten lava? To get a lava effect, the easiest thing to do is to climb your nearest volcano and shoot a picture straight into the caldera. Or search for a public domain image from the Internet. One of those, anyway. Once in possession of your lava image, open it in a separate tab from your main composition, hit Ctrl-A to select all, then Ctrl-C to copy it to the clipboard. Head back to your main image, and right-click the text layer in the Layers palette. Select "Create Work Path," then pop over to the Paths palette, select the work path, and convert it to a selection using the tiny dotted circle button at the bottom. Go to "Edit → Paste Special," select "Paste Into," and your lava image should appear within the boundaries of the text. If it's too small, and you can see the edges, hit Ctrl-T for Free Transform, and stretch it out—any pixelation that's caused by this process will be hard to spot because we can only see small parts of the image, and Photoshop is very good at upscaling.


C
MUM BS
Layer Style
Styles
Blending Options
☑ Bevel & Emboss
☐ Contour
☐ Texture
☐ Stroke
☑ Inner Shadow
☐ Inner Glow
☐ Satin
☐ Color Overlay
☑ Gradient Overlay
☐ Pattern Overlay
☐ Outer Glow
☐ Drop Shadow
OK
Cancel
New Style...
☑ Preview
Make Default
Reset to Default
Reset Alignment

Gradient Overlay
Gradient
Blend Mode: Normal ☐ Dither
Opacity: 100 %
Gradient: ☑ Reverse
Style: Linear ☑ Align with Layer
Angle: 92 °
Scale: 100 %

6 GLOW WITH THE FLOW

Our original lava-look lettering was a bit dark, so to brighten it up we pasted the texture image on to a new layer, which was placed on top of the stack in the Layers palette, leaving our original red lettering below it, but hidden. By changing the blend mode of the top layer to Screen, all the colors are lightened, so we're left with a glowing look more appropriate for molten rock [**Image D**]. When you're happy with what you've created, use the Layers menu to flatten your image, then save it as a JPEG for use in other documents [**Image E**]. ⏻


D
MINIMUM BS

BEYOND STRAIGHT

People read from left to right in English, so horizontal type is often all you need. For text that runs from right to left, enable Middle Eastern in Text Engine Preferences, and you can change direction in the Paragraph window. If you want more than text in straight lines, you can use Text on a Path. Get yourself a path using the Pen tool, or by converting a selection, then select the Type tool and click on your path. Now, anything you type follows the path. This is useful in a few situations where you want your type to bend round in a circle, for example, but in other situations, especially where the path is very complex, it's a sure-fire way to make your type unreadable. Use it with care.

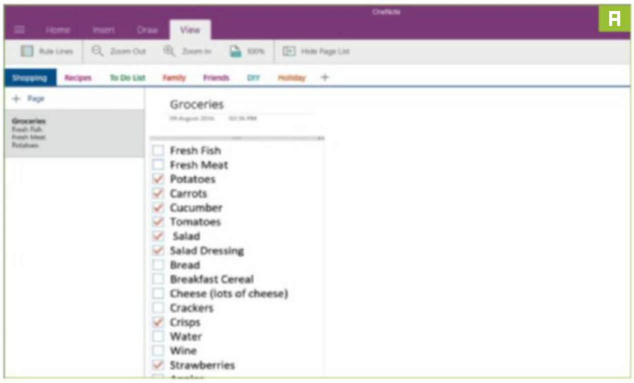
Take Super-Powered Notes for Free

YOU'LL NEED THIS

ONENOTE
Grab the app for free from
www.onenote.com.

WHEN IT COMES TO TAKING NOTES on your PC, smartphone, and tablet, nothing beats Microsoft OneNote. It's powerful, flexible, and free, with updates synched across all your devices. It's a great way to keep on top of what's going on in your world—and then share it with anyone.

OneNote lets you create and capture almost anything: a list of things to buy on your next shopping trip; vacation ideas, with pictures, notes, annotations, maps, and weblinks; lecture and meeting notes, with information and documents right there where you need them. You can even use it to work on projects with family, friends, and co-workers—it's the perfect collaborative tool. The more you use OneNote, the more things you'll discover it can do. Let's get started! –ROBERT MEAD-GREEN



Groceries

☐ Fresh Fish
☐ Fresh Meat
☑ Potatoes
☑ Carrots
☑ Cucumber
☑ Tomatoes
☑ Salad
☑ Salad Dressing
☐ Bread
☐ Breakfast Cereal
☐ Cheese (lots of cheese)
☐ Crackers
☑ Crisps
☐ Water
☐ Wine
☑ Strawberries

1 START A NOTEBOOK

When you first fire up OneNote, you'll discover that it has already created a default notebook for you, but you can add as many as you like by selecting the menu icon in the top-left corner of the app. Right-clicking any one brings up a contextual menu, enabling you to sync your notebooks, share them with others via a weblink, or even pin one or more to the Start menu.

2 ADD SOME CATEGORIES

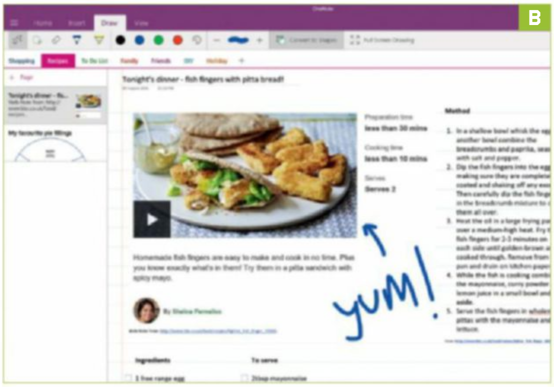
You can organize your notes under each notebook by adding category tabs under the Ribbon. Add titles to each one, and change the default colors if you want. To change the order of your tabs, drag and drop one to its new location, and all the others shift along. Add individual pages to each category by clicking "+ Page" in the menu bar on the left.

3 MAKE A NOTE

Click on the "+ Page" option, as in the previous step. In the main window, you can now add a title to your note, and then start adding whatever info you want. To create a checkable shopping list, for example [Image A], type the items you want to add, arranged in a list, then select the "Tag As To Do" icon under "Home." Checkboxes appear next to each item, which you can check off one by one.

4 ARRANGE AND RESIZE

If your list is too small or plain-looking, you can select the text within it, and use the text tools under "Ribbon → Home" to style it up. You can also move the list anywhere on the page by dragging and dropping using its grab bar, or change its shape by dragging each of its sides. You can also cut, copy, and paste items in the list by right-clicking to bring up a contextual menu.

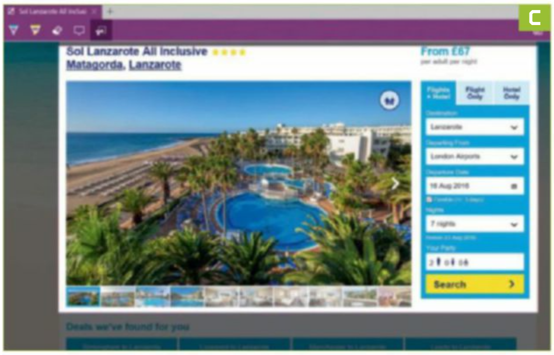


5 ADD MORE ELEMENTS

Because you can move items around the page in your notes, OneNote makes it easy to add lots of other elements—pictures, doodles, weblinks, and so on. What you can't do is make audio or video recordings within the desktop version of OneNote—that is now a mobile-only feature [Image B]. Luckily, you can listen to these or watch them on your PC later, because they sync in the cloud.

6 GRAB THE WEB

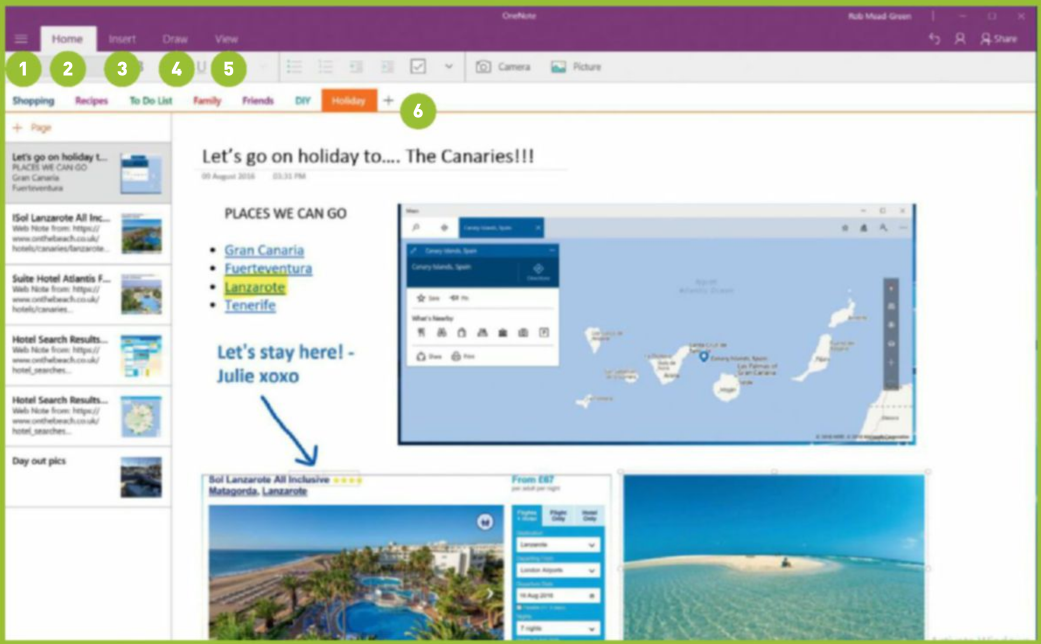
One of the best things about OneNote is that it gives you the ability to grab webpages, or bits of them. So, let's try it: Open Microsoft Edge, select a webpage you want to grab, then select the "Make a Web Note" icon. You can now use OneNote's tools to annotate it, or use the Clip tool to grab just a section. When you're done, select the "Save Web Note" icon to add it to OneNote [Image C].



ONENOTE DESKTOP

1. NOTES
Click or tap here to bring up a list of all your notebooks, and add new ones. You'll find app settings and printing options here, too.

2. HOME
This is where you add individual pages to your notebooks, and make notes using text options in the Ribbon. You can add pictures and video, too.


OneNote
Rob Mead-Green
Home
Insert
Draw
View
1
2
3
4
5
Camera
Picture
Share
Shopping
Recipes
To Do List
Family
Friends
DIY
Holiday
6
Page
Let's go on holiday t...
Sol Lanzarote All Inc...
Suite Hotel Atlantis F...
Hotel Search Results...
Hotel Search Results...
Day out pics

Let's go on holiday to.... The Canaries!!!

PLACES WE CAN GO

- Gran Canaria
- Fuerteventura
- Lanzarote
- Tenerife

Let's stay here! - Julie xoxo

Sol Lanzarote All Inclusive
Matagorda, Lanzarote

3. INSERT
This option gives you the ability to add anything else to your notes —tables, relevant documents, and pictures, as well as weblinks.

4. DRAW
Need to annotate your notes? The Draw tab includes a range of basic drawing tools to help you—there's even a highlighter pen.

5. VIEW
This gives you the ability to change the look of your notes, from adding a variety of rule lines, to zooming in and out of each page.

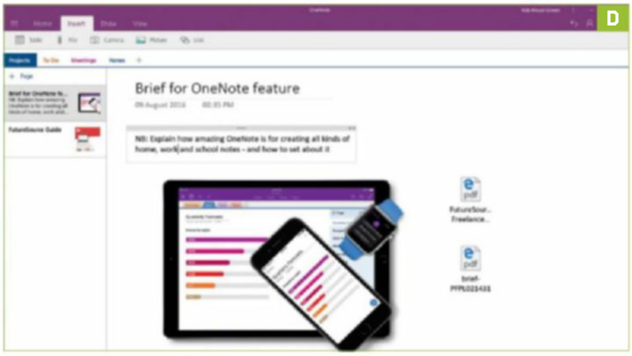
6. NOTEBOOK TABS
Add order to your notes by filing them under different tabs. You can change tab titles, colors, and their running order at any time.

7 ADD YOUR DOCUMENTS

There will inevitably be times when the stuff you need is available elsewhere—maybe as a separate Office document or PDF on your PC. You can make sure you don't lose track of these by heading to "Ribbon → Insert → File," and adding the files as an attachment, which you can double-click to open in the relevant app [Image D]. You can also insert the content of PDFs directly.

8 BUILD A TABLE

Head to "Ribbon → Insert → Table," and you can create one right there and then. You can add columns by simply pressing the Tab button on your keyboard. Rows are created by pressing Enter at the end of the final column. You can resize the table any way you wish, but OneNote is also clever enough to automatically resize columns and rows for you as you type.


D
Home
Insert
Draw
View
Page

Brief for OneNote feature

NB: Explain how amazing OneNote is for creating all kinds of home, work and school notes - and how to set about it

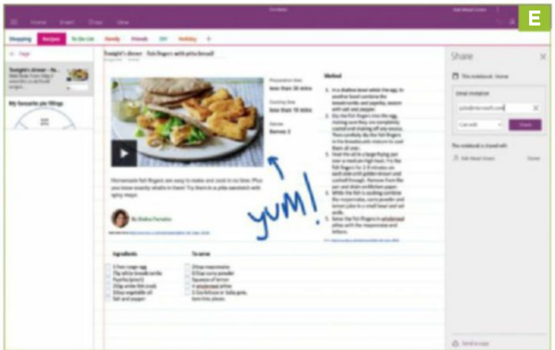
pdf
FutureTour...
Freelance...
pdf
brief-PPRL023431

9 GET DOODLING, DUDE

You don't have to type notes using your keyboard—write them freehand using "Ribbon → Draw" instead. Choose the color and line thickness using the contextual tools, then use the mouse, trackpad, or your finger (if you have a touchscreen) to doodle away. If you're useless at drawing shapes, select "Convert To Shapes" to sort them.

10 GOOD TO SHARE

If you would like someone else to work on your note with you, use the "Share" option in the top-right. Clicking "Share" brings up the Sharing pane [Image E], which asks you to invite someone to work on the note with you using OneNote online, or their own version of the app. Or you can send them a non-editable copy. ⏻



Make a USB Stick Emergency Toolkit

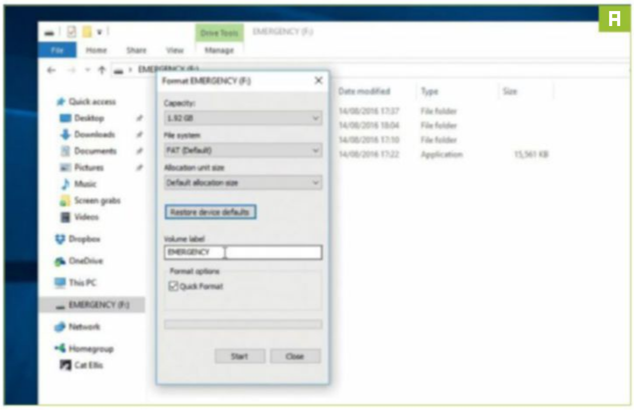
YOU'LL NEED THIS

USB STICK

We recommend using a USB stick about 1GB in size.

VIRUSES, MALWARE, ACCIDENTAL DELETION, or corrupted data can all put your valuable files at risk. The best insurance is to make regular backups, but what if you run into trouble in between backups, or you let your routine slide, or a friend has a crisis with their PC? That's where an emergency USB toolkit of portable apps comes in, giving you everything you need to fix the damage, and save the day.

When you install a program, not only are the files it needs to run saved on your hard drive, but it also makes its own changes to the rest of your system, such as adding entries to the Registry. Portable apps don't do this, so you can save them to a USB stick, and use them on any PC by double-clicking the program's EXE file. Here's our selection of the best ones for emergencies. **–CAT ELLIS**


A
Drive Tools
EMERGENCY (F:)
File
Home
Share
View
Manage
Quick access
Desktop
Downloads
Documents
Pictures
Music
Screen grabs
Videos
Dropbox
OneDrive
This PC
EMERGENCY (F:)
Network
Homegroup
Cat Ellis
Date modified
Type
Size

Format EMERGENCY (F:)

Capacity: 1.92 GB

File system: FAT (Default)

Allocation unit size: Default allocation size

Volume label: EMERGENCY

Format options: ☑ Quick Format

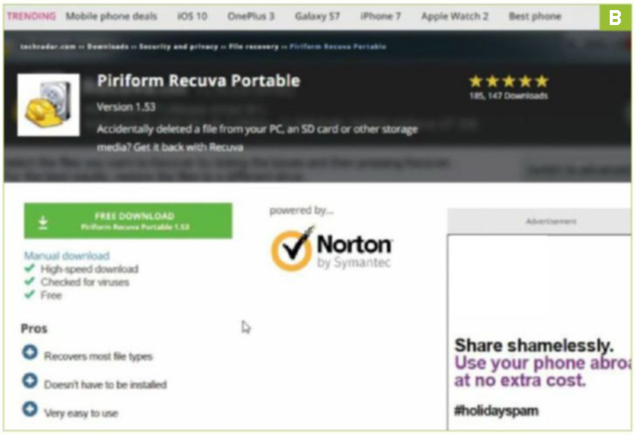
Restore device defaults
Start
Close

1 GET YOUR USB STICK READY

First, you need a USB memory stick—1GB is fine. Plug it into your computer, open Windows Explorer, then right-click your USB stick in the menu on the left. Select "Rename," and call it "Emergency." If you've used the memory stick before, you can wipe it by right-clicking it, and selecting "Format → Restore device defaults → OK" [**Image A**]. Make sure there isn't anything you want to keep on the stick first.

2 PREPARE FOR ACCIDENTS

Now we need to start building our toolkit. A common disaster is accidentally deleting a file—whether it's from your hard drive, an SD card, or other storage. Piriform Recuva [**Image B**] can help you get it back, but installing this after you've lost files can result in them being overwritten, so it's far better to have it ready to run from your USB stick. Download it from www.piriform.com/recuva—using "Manual download" is easiest.


B
TRENDING
Mobile phone deals
iOS 10
OnePlus 3
Galaxy S7
iPhone 7
Apple Watch 2
Best phone

Piriform Recuva Portable

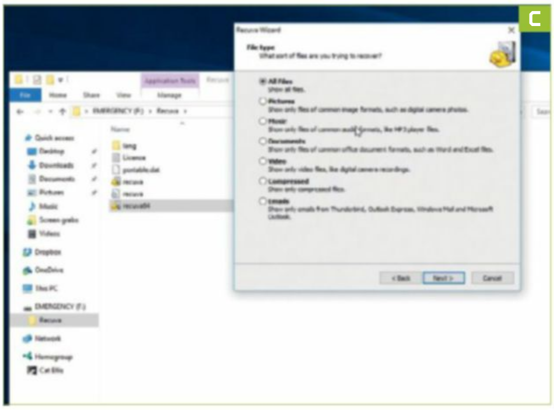
Version 1.53

Accidentally deleted a file from your PC, an SD card or other storage media? Get it back with Recuva

FREE DOWNLOAD
Piriform Recuva Portable 1.53
powered by...
Norton by Symantec
Advertisement
Share shamelessly.
#holidayspam

Manual download
- ✓ High-speed download
- ✓ Checked for viruses
- ✓ Free

Pros
- Recovers most file types
- Doesn't have to be installed
- Very easy to use


C
Application Tools
File
Home
Share
View
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EMERGENCY (F:) › Recuva
Name
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recuva64
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Desktop
Downloads
Documents
Pictures
Music
Screen grabs
Videos
Dropbox
OneDrive
This PC
EMERGENCY (F:)
Recuva
Network
Homegroup
Cat Ellis

Recuva Wizard

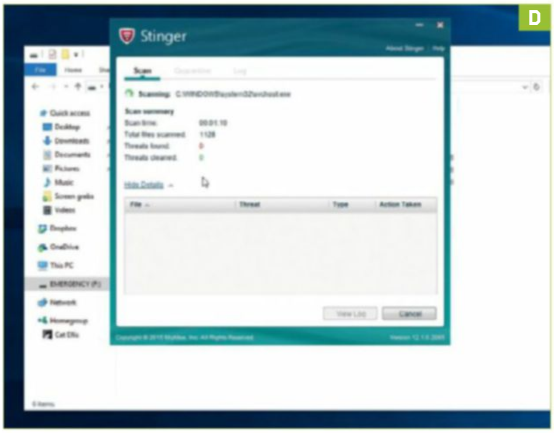
File type
What sort of files are you trying to recover?

- ● All Files
  Show all files.
- ○ Pictures
  Show only files of common image formats, such as digital camera photos.
- ○ Music
  Show only files of common audio formats, like MP3 player files.
- ○ Documents
  Show only files of common office document formats, such as Word and Excel files.
- ○ Video
  Show only video files, like digital camera recordings.
- ○ Compressed
  Show only compressed files.
- ○ Emails
  Show only emails from Thunderbird, Outlook Express, Windows Mail and Microsoft Outlook.

< Back
Next >
Cancel

3 RECOVER DELETED FILES

Now click the downloaded ZIP file, and select "Extract → Extract all." Click "Browse," then select your USB stick. Right-click, and create a folder called "Recuva" (to make it easier to find in future). Open this folder, and click


D
Stinger
Scan
Quarantine
Log
Hide Details
View Log
Cancel

Scan summary

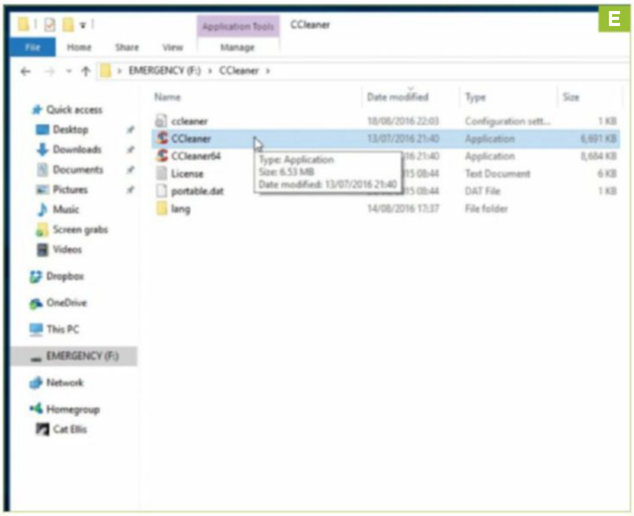
Scan time: 00:01:10

Total files scanned: 1128

Threats found: 0

Threats cleaned: 0

File	Threat	Type	Action Taken


E
Application Tools
CCleaner
File
Home
Share
View
Manage
EMERGENCY (F:) › CCleaner
Quick access
Desktop
Downloads
Documents
Pictures
Music
Screen grabs
Videos
Dropbox
OneDrive
This PC
EMERGENCY (F:)
Network
Homegroup
Cat Ellis
Name
Date modified
Type
Size
ccleaner
CCleaner
CCleaner64
License
portable.dat
lang
Type: Application
Size: 6.53 MB
Date modified: 13/07/2016 21:40

"Select folder → Extract." Now, if you ever need to restore a deleted file, just plug in your USB stick, double-click Recuva.exe, and follow the instructions [**Image C**].

4

DOWNLOAD A VIRUS-ZAPPER

If you suspect your PC has been infected with a virus, McAfee Stinger can help stop it in its tracks. Download it from www.mcafee.com/uk/downloads/free-tools/stinger.aspx. This program doesn't come in a ZIP archive, so once it's downloaded to your PC, you can drag the EXE file straight to your USB stick using Windows Explorer. When you want to run it, just double-click the file, and click "Scan" [**Image D**].

5

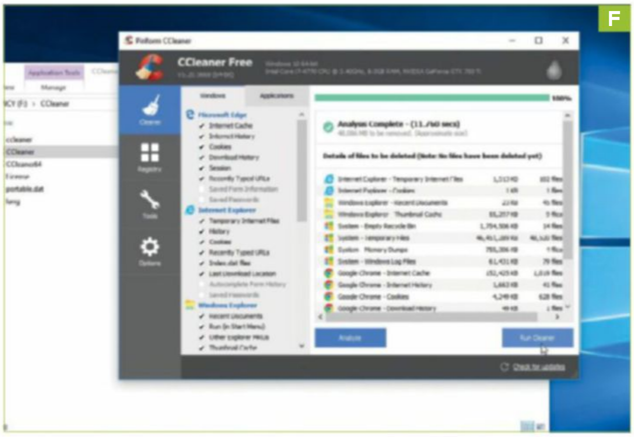
GET READY FOR A DEEP CLEAN

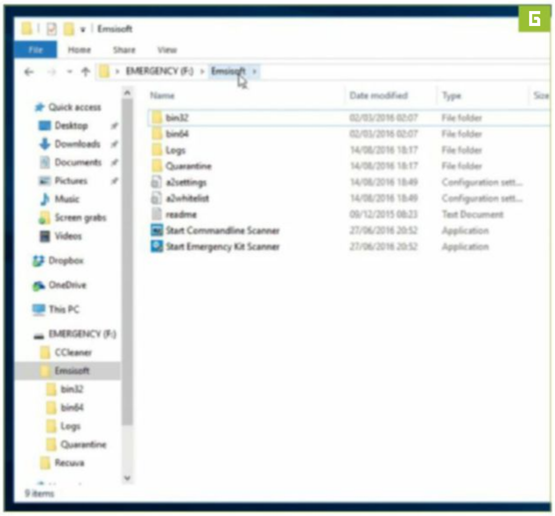
If your PC is running more slowly than it used to, or you're getting error messages about corrupted files, CCleaner can save the day. Download it from www.piriform.com/ccleaner/builds (it's the second link), then extract the downloaded file to your USB stick, just as you did for Recuva, saving it in a new folder called "CCleaner." Whenever you need to run it, just double-click the CCleaner.exe file [**Image E**].

6

SWEEP AWAY JUNK AND FIX ERRORS

To free up extra space and improve performance, click "Analyze," and CCleaner searches your hard drive for any unnecessary files. Once it's finished, look through the list, uncheck the boxes next to anything you want to keep, then click "Run Cleaner" [**Image F**]. To solve errors with the Windows Registry, select "Registry" from the menu on the left, then select "Scan for issues → Fix selected issues."


F
CCleaner Free
Cleaner
Registry
Tools
Options
Windows
Applications
Analysis Complete
Analyze
Run Cleaner
Check for updates


G
Emsisoft
File
Home
Share
View
EMERGENCY (F:) › Emsisoft
Quick access
Desktop
Downloads
Documents
Pictures
Music
Screen grabs
Videos
Dropbox
OneDrive
This PC
EMERGENCY (F:)
CCleaner
Emsisoft
bin32
bin64
Logs
Quarantine
Recuva
Name
Date modified
Type
Size
bin32
bin64
Logs
Quarantine
a2settings
a2whitelist
readme
Start Commandline Scanner
Start Emergency Kit Scanner
9 items

7

GET SET TO BLAST MALWARE

Emsisoft Emergency Kit, which is available from www.emsisoft.com/en/software/eek/, checks your computer for programs that aren't strictly viruses but are still malicious. Double-click the downloaded file, and it runs an installer, which automates the process of extracting the files from a ZIP archive. Select your USB stick as the destination, make a folder called "Emsisoft," and click "OK" [**Image G**].

8

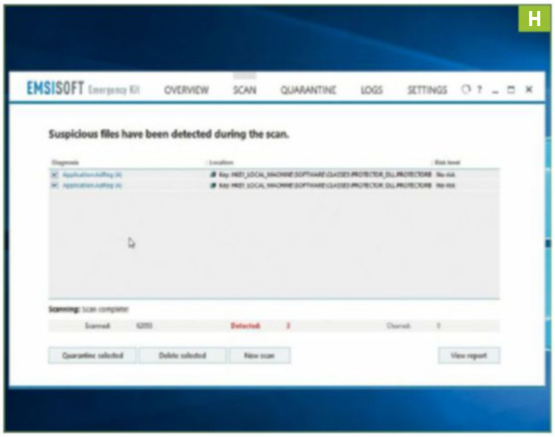
READY FOR ANYTHING

Double-click "Start Emergency Kit Scanner," and let Emsisoft update itself. Now, whenever you think your PC has a malware infection (you notice unexpected changes to your web browser, for example), insert your USB stick, launch Emsisoft, click "Scan," and follow the instructions to deal with the issue [**Image H**]. Label the USB stick and keep it handy—you never know when you might need it.

9

ONE LAST POINT

You might have extra room on your USB stick once you've finished installing your emergency apps, but don't use it for regular file transfers—you don't want to risk losing it! ⏻


H
EMSISOFT Emergency Kit
OVERVIEW
SCAN
QUARANTINE
LOGS
SETTINGS
Suspicious files have been detected during the scan.
Scanning: Scan complete
Detected
Quarantine selected
Delete selected
New scan
View report

BUILD IT

ZAK STOREY, REVIEWS EDITOR

Dream Machine 2016

A peek behind the scenes at the build process of the greatest PC we've pieced together this year

LENGTH OF TIME: **20–36 HOURS**

LEVEL OF DIFFICULTY: **EXTREME**

THE CONCEPT

IF YOU'VE HAD A GANDER at our Dream Machine feature on page 24, you'll be well aware of the concept behind that strapping system: pushing the maximum amount of hardware we can muster into a machine that's viable, practical, and a little extreme. This time around, however, a lot has changed in the world of graphical fidelity. With Nvidia dropping SLI support above two cards, and the Titan X harboring little competition between it and any offerings from AMD, it gave us real pause for thought about how we were going to spec this year's monster. In the end, we opted for a combination of processing power, storage, and motherboard superiority, as opposed to maximum graphical fidelity. Because the Titan X is rather thin on the ground, and impractically expensive, we opted to go for the far better value-for-money GTX 1080s—namely, two of MSI's GeForce GTX 1080 Gaming X 8Gs. MSI has produced some fantastic cards this time around, and we're yet to see a card we can't overclock like crazy. Having two of these in SLI is more than enough to satisfy all of our 4K gaming needs—at least until those 120Hz panels drop early next year.

So, what's so special about the storage? Well, apart from the 1.2TB Intel U.2 750 PCIe SSD, we also garnered four of Hitachi's helium-filled 10TB drives, weighing in at an astronomical $750 apiece. These drives are enterprise grade by design, and provide some phenomenal performance for spinning platters. Throw four of them into RAID 0 or RAID 10, and you're looking at some serious speed, comparable to SSD sequentials, with plenty of redundancy to back it up. But we've already waxed lyrical about all the hardware in the main feature, so let's take a look at how we put this water-cooled wonder together.

FULL TOWER HARDLINE COOLING

WHAT WE'VE NEVER REALLY DONE in *Maximum PC* is show you how exactly we go about the build process for the Dream Machine. And this year's was tougher than ever. After a few debates in the office, our resident Linux guru and political activist, Alex, specced up a water-cooled system for this year's Dream Machine, before handing it over to our hardline pro and handy reviews editor (aka me) to build in under two days. And thus began the challenge. The In Win 909 is a beautiful case, perfect for water cooling, and ideal for people interested in modding. However, for the less experienced, it houses a potential minefield of problems—especially if you don't have the tools on hand to go about your modding business.

The first thing we needed was a plan of attack. We decided a twin loop was going to be important this year. It's not every day you get the opportunity to build something quite like the Dream Machine, so running two separate loops, one for the GPU and one for the CPU, seemed like the best choice. It's imperative that you keep an open mind when planning a build like this. Buy more fittings than you think you need, get hold of twice as much tubing, and be prepared to make some crucial decisions about how you're going to cool your loop as you go.

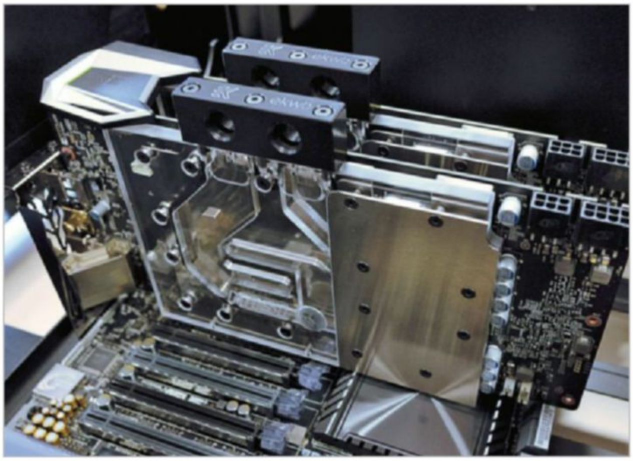
COOLING INGREDIENTS

PART		STREET PRICE
CPU Waterblock	EK-Supremacy EVO Elite Edition – Intel 2011-3	$119
GPU Waterblocks	2x EK-FC1080 GTX TF6 – Nickel	$267
Reservoirs	2x EK-RES X3 250	$119
Pumps	2x EK-XTOP DDC 3.2 PWM Elite – Acetal	$225
Radiators	2x EK-CoolStream PE (240 & 360)	$161
Compression Fittings	22x EK-HDC Fitting 12mm G1/4 – Nickel	$106
45° Fittings	3x EK-AF Angled 45° G1/4 – Nickel	$19
90° Fittings	11x EK-AF Angled 90° G1/4 – Nickel	$84
T Splitter	EK-AF T-Splitter 3F G1/4 – Black	$10
Tubing	8x EK-HD PETG Tube 10/12mm 500mm (2pcs)	$52
Coolant	4x EK-Ekoolant Pastel Concentrate 250ml (Lime Green and White)	$65
Fans	4x EK-Vardar F4-120ER (2,200rpm)	$73
Total		$1,300

1

INSTALLING THE GPU WATERBLOCK

ATTACHING WATERBLOCKS to graphics cards is daunting, just follow the included instructions, and you'll be done in no time. Take it easy, bone up on where you need to apply your thermal paste, make sure you've covered all your memory chips and VRMs with thermal pads as indicated, and you're on to a winner. The biggest problem is removing the attached cooler. Word of warning: You will void the warranty by removing it. However, the waterblocks are sealed, and the only potential place for a leak is at the G1/4 threads for the fittings. Blocks aside, our problem was how to set up our SLI config. We split the cards a bit further apart to get a prettier water-cooling bridge between them.



2

PSU INSTALLATION

WE ORIGINALLY INTENDED to use EVGA's Supernova 1600 T2 to power the Dream Machine, but due to issues with size (and, as you can see, mounting), it wasn't a viable option. We ended up opting for the shorter Be Quiet! Dark Power Pro 11 instead, just to provide us with enough room to fit the cables, and have a power supply that lay completely flat once secured in place.

Always double-check what size power supply your case can handle. Ideally, you don't want to end up in a situation like this, struggling to fit it correctly, and with limited cable management room. The In Win 909 also only supports power supply installation with the fan facing up, because there's no airflow mesh below.

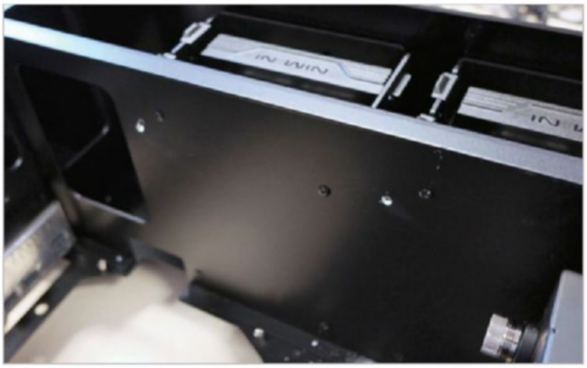
GA SUPERNOVA
00 T2
1600W TITANIUM POWER SUPPLY

3

DRILLING DELIGHTS

THE EAGLE-EYED AMONG YOU will have already seen that our GPU reservoir is pitched up above a pump held in place by a single piece of tubing. EKWB's PETG tubing is particularly strong compared to standard acrylic, and won't crack at all, thanks to an improved chemical formula, making it more than ideal for this job. For the CPU reservoir, we decided to mount it at the top of the chassis. To do that, we broke out the trusty Dremel, marked two locations, using the mounting brackets as a guide, then drilled away, ensuring we didn't hit the hard drive cages, and avoiding the rivets in the process.

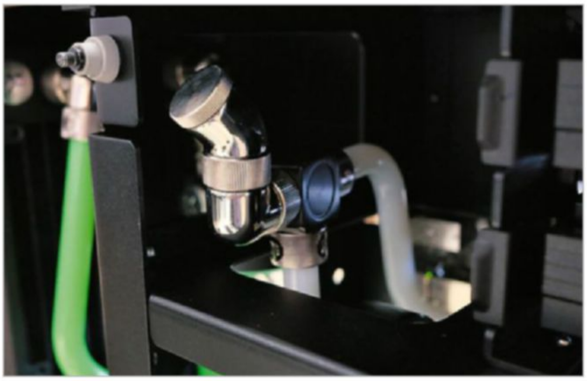
It goes without saying that you mustn't have any hardware installed while doing this, because getting conductive metal shavings over your gear is going to lead to trouble.



4

FILLING HORIZONTAL RESERVOIRS

THE MOST IMPORTANT RULE for water cooling is that your pump is always gravity-fed by a reservoir. If you run a pump dry, it damages the bearing inside, because the coolant acts as a lubricant. The problem with having a horizontal reservoir, then, is that you need to fill it to a certain height with a closed loop to get the coolant flowing and the loop primed. To do this, we used one of EKWB's T Splitters, to provide us with an additional fill port at the top of the system. This way, we could pump the reservoir full of coolant, and ensure the pump remained wet without worry. This didn't entirely alleviate our problems, however—we had to orient the case on to its front, then twist that 45° fitting round, so we could fill it vertically, to ensure there wasn't too much air trapped inside the CPU block and pump.

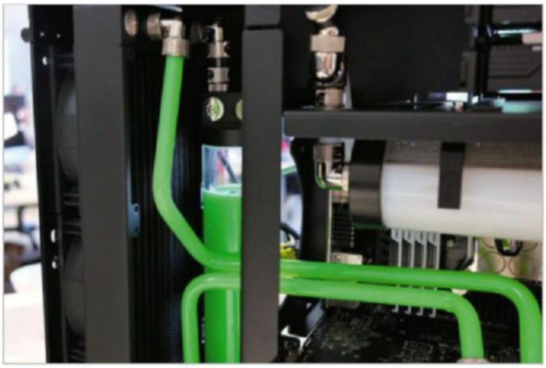


5

DIFFICULT BENDS

THE MOST DIFFICULT BENDS were the two leading out of the GPUs. Hardline tubing is a one-hit wonder: You can only bend it once—rebending can cause nasty kinks and bubbles, which you don't want. On top of that, once you remove the silicon insert from the tubing, you can't get it back in and around a bend, no matter how hard you try.

Your best bet is to take your time, be patient, measure it as best you can, and try to make sure you don't have any ridiculous bends, such as a 45° going into another 45° going into a third 45°. Like we did here. Yeah. Don't do that. It's always advisable to buy twice as much tubing as you think you'll need. And, where you can, rely on angled fittings to relieve some of the burden.

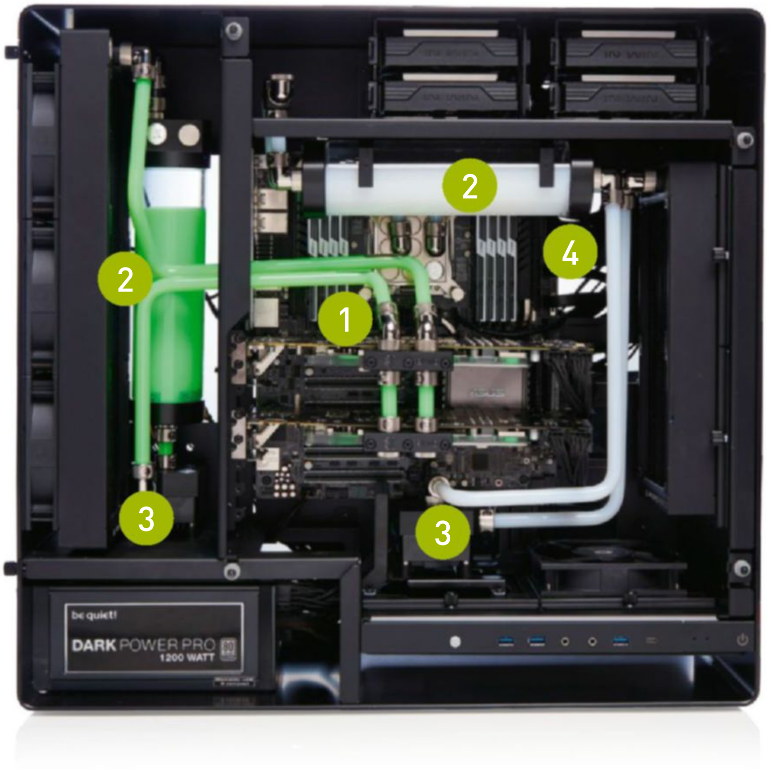


6

DOUBLE-CHECK EVERYTHING

EVEN PROS MAKE MISTAKES. During initial testing and after filling and priming your loop, always do what we call a leak test. In short, cover all your hardware in paper towels, ensure everything is disconnected, except for the pumps, and cycle the loops using a PSU bridge. This way, you can tell whether there are any leaks, and correct them. The last thing you want is a leak while your rig is turned on. It's advisable to do this while the initial fill occurs.

We foolishly forgot to check one of our horizontal reservoir caps properly, and after several failed attempts at tightening it in a bid to stem a leak, realized that one of the caps was actually missing its O-ring entirely. A quick drain, analysis, and refill, and we were good to go.



1 Thanks to the power of thermal dynamics, loop orientation doesn't have much of an impact on temperatures, especially on these GPUs.

2 It's vital that you always keep your pumps gravity-fed by a reservoir—we can't stress this enough. Never, ever run a pump dry.

3 Ideally, you'll want to have a drain port somewhere in your system. Place it at the lowest point in each loop if you can, to make it easier to drain and refill later on. Confession: We don't have one, and we should.

4 It's worth working from the back of the case inward when it comes to water cooling. Do the bends in the back of the build first, then work on the ones closest to you, to avoid hassle later on.

DREAM MACHINE COMPLETE

AS WE'VE ALREADY taken a look at benchmarks in our main Dream Machine feature on page 24, we'll stick to talking about how it was to build this beauty, and what tips and tricks we can give you if you decide that you want to work on your own dream PC.

In short, In Win's 909 chassis is an incredibly versatile piece of gear. The removable fan and radiator mounts are a stroke of genius—strong, sturdy, and easy to mess around with. In fact, we changed the orientation of fans and radiators too many times to count in this build—but, fortunately, it didn't take long to swap it all around. As always, this water-cooled build didn't turn out as planned, but that's the beauty of it. Unless you're a dab hand with 3D modeling, and can render the internals, including dimensions, ahead of time to plan your runs, it's exceptionally difficult to design in detail. It's all about getting a rough idea of how you want the loop to go.

The biggest problem when it came to initial construction was those GPU runs to the radiator and reservoir. The concept of bending a 45° one way, then one the opposite way, then a third heading up in a 90° angle takes some serious work. It took us six attempts before we reached something that would both fit and look good. Most of the time, this was down to the tubing run being too short, way off angle, or just finding it hard to measure up exactly how we were going to achieve it. Given more time, it would have been possible to get it just right, but the Dream Machine can't wait forever, and we'd already spent too long waiting on potential hardware solutions to postpone it any further.

The second biggest challenge was the CPU loop. By now, you're probably thinking it's pure madness. An Intel Core i7-6950X, overclocked to 4.2GHz, being cooled by a single 240mm radiator. And we agree—honestly, we didn't think it would be possible, but it worked out well. The hunch stemmed from the idea that the difference you gain in temperature from utilizing different fans to cool an AIO is so minor that, potentially, what's more important is that air is passing through the case. And if that's true, we could perhaps get away with it, by utilizing a thicker radiator instead, because EKWB's PE editions are, in fact, twice as thick as a standard slim AIO. On top of that, it gave us more room to work with when it came to those tubing runs, while simultaneously reducing noise, and helping cable management.

Given more time, we would have perhaps opted for a larger chassis. And a more substantial graphical solution. But don't worry—ideas are already floating around for next year's Dream Machine, and as our hardline skill set becomes ever more developed and complex, we're confident that the only way is up. Ultimately, we hope this inspires you to attempt your own custom modifications, your own water-cooled machines of madness, and that our efforts confirm the most important aspect of custom PC building: As a platform, these systems are the most versatile on the planet.

BENCHMARKS

	ZERO-POINT	
Cinebench R15 Multi-Thread	987	2,092 (112%)
Cinebench R15 Single-Thread	196	167 (-14.8%)
TechARP's X264 HD 5.0.1 (fps)	21.93	43.86 (100%)
Total War: Attila	43	64 (49%)
Rise of the Tomb Raider	41	85 (107%)
Far Cry Primal	72	153 (113%)
The Division	42	72 (71%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our desktop zero-point PC uses a Core i7-6700K CPU @ 4.6GHz, an AMD R9 Fury X, and 32GB of RAM. All games are tested at 1080p on max settings, with HD texture packages installed.

72
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REVIEWS

TESTED. REVIEWED. VERDICTIZED.

XLR8
PNY
NVIDIA

INSIDE

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82 AOC U3277PWQU
84 SteelSeries Siberia 840
86 Corsair Carbide Air 740
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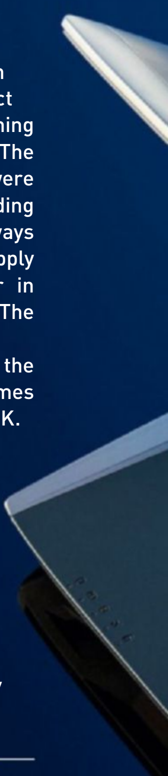
PNY GEFORCE GTX 1080 XLR8 OC PAGE 78

Asus ROG GX800VH

One laptop, two power bricks? That'll be Asus's new gaming monster



CONVENTIONAL WISDOM dictates that laptops are about portability. If that's true, it's safe to assume that Asus regards conventional wisdom as something akin to an inebriated hobo with dubious standards of personal hygiene. Because with the ROG GX800VH, Asus is positively spurning portability. This is possibly the least portable laptop ever.

It's a monumental 18-inch beast. In fact, even the 18-inch metric doesn't do it justice. Thanks to generous bezels around the screen, it could easily accommodate a 19-inch panel. But that's just the beginning. Not only does it come with two enormous 330W power bricks, both of which must be used to achieve full performance, but there's also a meaty docking station, which houses liquid cooling for the two Nvidia graphics chips inside the laptop itself.

An 18-inch LCD panel, two power bricks, and an external water cooler—total mass? Just under 29 pounds. Insanity? Without question. But if it's your kind of insanity, who are we to judge, other than to assess how good it is at being an 18-inch laptop, with two power bricks, and a water cooler?

The spec is certainly impressive. The GPUs are a pair of desktop-spec Nvidia GeForce GTX 1080s, and the 18-inch display is a full 4K item, with IPS technology, and Nvidia G-Sync support. Next up is 64GB of RAM, and a trio of 512GB Toshiba NVMe SSDs. The only relative disappointment is the Intel Core i7-6820HK. It's not bad per se, but if there's room for a pair of desktop GPUs with liquid cooling, you might think Asus could have found a way to squeeze in a full-on LGA2011 processor of some kind.

Beyond the headline specs, there's a whole hill of bespoke engineering. The most spectacular involves that water-cooling dock. It's there for the GPUs primarily, but also cools the CPU, and even the RAM. You simply drop the rear of the laptop on to the dock, courtesy of the guide pins, and use the metal clasp to secure the self-sealing valves for the liquid-cooling array. It sounds like an accident waiting to happen, but it works well.

A HIGHER POWER

Asus provides a handy desktop software tool that delivers easy access to global settings, and hand-tuning for expert overclocking. It's clever enough to detect when both power supplies are connected, and jump to a higher performing mode.

With a single PSU attached, the CPU clock is capped at 3.6GHz, and the GPUs run at 1,190MHz. Add the second PSU, and those numbers jump to 4.2GHz and 1,771MHz. In theory. If there's a problem with this, it's the complexity. The configuration options are borderline baffling. You can run connected to the dock with one or two power supplies, or run the laptop by itself on purely air cooling and a single power supply. Of course, there's the SLI graphics, which make getting consistent performance out of any machine more complicated.

To cut a long story short, we tried the GX800VH in every imaginable configuration, and ran most of our benchmarks in each configuration to investigate the impact of adding the second PSU, and running with and without the liquid cooling. The results were always fast. But they were also consistently inconsistent. Depending on the test in question, it wouldn't always run faster with the second power supply plugged in. Some games ran faster in some configurations at 4K than 1080p. The numbers were all over the place.

In mitigation, even at its worst, the GX800VH is one hell of a fast laptop. Games look fantastic and run pretty well at 4K. Our review sample was also pre-production, with some features—including G-Sync support—missing. Asus is working on final refinements for retail models. But this is a very complex machine, and there's no doubt that a conventional desktop is the better route to a high-performance PC that does its thing with consistency. It really is that simple. **–JEREMY LAIRD**

VERDICT 8

Asus ROG GX800VH

➕ IN THE MONEY Massive spec; huge performance; intriguing bespoke engineering.

➖ DIMINISHING RETURNS Catastrophically pricey; thoroughly non-portable; inconsistent performance.

$6,000 (Estimated), www.asus.com

BENCHMARKS

	ZERO-POINT	
Cinebench R15	682	847 (24.2%)
x264 HD 5.0 (fps)	15.17	18.8 (23.7%)
CrystalDiskMark 4K Read (MB/s)	44	42 (-4.5%)
CrystalDiskMark 4K Write (MB/s)	162	141 (-13%)
Far Cry Primal (fps)	37	77 (108%)
The Division (fps)	33	88 (167%)
Rise of the Tomb Raider (fps)	42	133 (216%)
3DMark Fire Strike	6,583	22,168 (237%)

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Our laptop zero-point is the Asus G752VT-DH72, with an Intel Core i7-6700HQ, a 3GB GTX 970M, and 16GB of DDR4-2133. *Far Cry Primal* and *The Division* tested at Ultra settings at 1080p. *Rise of the Tomb Raider* tested at Very High settings with SMAA at 1080p.

SPECIFICATIONS

Processor	Intel Core i7-6820HK
Graphics	2x Nvidia GeForce GTX 1080
RAM	64GB
Screen	18.4-inch, 4K, IPS
Storage	3x 512GB NVMe SSD
Keyboard	Mechanical keyboard with ROG Aura
Cooling	Liquid-cooling dock, integrated air cooling
Battery	72WHr
PSU	2x 330W
Total Weight	29lb
Warranty	One year

The Asus ROG GX800VH comes with a bespoke backpack. But it still isn't exactly portable.

PNY GeForce GTX 1080 XLR8 OC

Overclocked? That's a matter of opinion

PERHAPS IT'S BECAUSE we've been receiving cherry-picked GPUs this last year, or perhaps we were just a little unlucky in the silicon lottery, but the XLR8 OC just doesn't seem to live up to its name. As GTX 1080s go, it certainly seemed like a card capable of shaking up the ecosphere. With a smallish form factor, triple-fan dissipation design, one of the lowest prices we'd seen, and an aftermarket PCB, it was set to be a winner from the get-go. Or so it seemed.

Where did it go wrong? Well, perhaps a little too much emphasis was placed on the marketing and naming scheme; perhaps PNY isn't sufficiently experienced when it comes to developing overclockable PCBs—either way, we struggled to push it very far past its stock clocks. We understand: It's all about those sales figures. The graphics industry is an aggressive business, the number of manufacturers is dwindling, and as the lines blur between consumer and enterprise products, commercial companies such as PNY are looking to expand into PC gaming as well, to ensure they have income and revenue for the future. It's admirable, very admirable. However, PNY hasn't spent the same amount of time or gained the same amount of experience as the other big dogs when it comes to card design, and it shows.

SUCH SADNESS

So, what's so heinous that we've had to write two paragraphs condemning the nature of the beast? In short, it all goes back to our reference card. At stock, we could push the Founder's Edition up by 260MHz on the core clock, and 500MHz on the memory—that's a sizable portion. Compare that to the XLR8 OC card, and the maximum we could achieve on the core was 50MHz, with 400MHz on the memory, before running into trouble. As such, our Fire Strike score varied by as much as 508 points between the two. It doesn't sound like a lot, but when you consider the whole premise that the XLR8 card was designed around, it paints a different story.

That said, the card performs incredibly well at stock. There's no proprietary software or embedded overclock profiles here, just good old-fashioned GPU boost bringing up the core clock. As standard, you should achieve a final boost just pushing the 2GHz mark. In fact, in most titles, it outstrips the Founder's Edition by around two to three frames per second on average, and considering the card costs $50 less than its flashier competitor, we can't help but be impressed. At 1080p, the GTX 1080 is still the monster core that we expect; it pumps out well over 100fps in both *Far Cry Primal* and *The Division*, and hits a pleasingly comfortable 60fps-plus in *Rise of the Tomb Raider* and *Total War: Attila*, two titles renowned for testing your hardware. At 1440p, you're still well into the high 70s for most titles. And even single-card 4K is entirely feasible, given enough tweaking to some key settings (antialiasing in particular).

As far as aesthetics go, it harks back to the earlier GTX 500 and 600 series. There's no RGB lighting, just a simple red LED setup spinning around the three fans. On top of that, you get a clean backplate, with no fancy engraved logos or ventilation holes—just a clean, quiet, cool card. If we have any complaints, the plastic used on the shroud does look a little too shiny, but that's hardly going to affect performance.

Overclocking prowess aside, the XLR8 is a well-built, well-specced card, for $50 less than the Founder's Edition. It outperforms some of the more extreme GTX 1080s we've seen, and despite its overclocking setbacks, and slightly clusmy name, we believe that if you're looking to get the best-value GTX 1080 money can buy right now, PNY's XLR8 OC edition is well worth the investment. **–ZAK STOREY**

VERDICT
8

PNY GeForce GTX 1080 XLR8 OC

+ **AM4Z3B411S** Great stock performance; GTX 1080 heart; clean look; just plug and play; price.

− **4WFU1** Overclocking falls short; plasticky.

$650, www.pny.com

BENCHMARKS

	PNY GTX 1080 XLR8 OC	Asus Strix GTX 1080 OC	Nvidia GTX 1080 Founder's Edition
Total War: Attila (fps)	**24**/40	21/**42**	23/40
Far Cry Primal (fps)	67/78	**68/80**	65/77
The Division (fps)	35/72	**41/75**	39/73
Rise of the Tomb Raider (fps)	**17**/43	**17/45**	16/42
Fire Strike Extreme (Index)	9,369	**9,958**	9,371
Fire Strike Extreme OC (Index)	10,045	9,982	**10,474**

Best scores are in bold. Game results are minimum and average fps at 1440p. Our test bed consists of an Intel Core i7-6700K, 16GB of DDR4, and an MSI Z170A Gaming M7 motherboard.

SPECIFICATIONS

GPU	Pascal
Lithography	16nm FinFET
Transistor Count	7.2 billion
CUDA Cores	2,560
Texture Units	160
ROPs	64
Core/Boost Clock	1,607/1,733MHz
Memory Capacity and Type	8GB GDDR5X
Memory Speed	10GB/s
Memory Bus	256-bit
TDP	180W
Display Connectors	DisplayPort 1.4, HDMI 2.0(b)

PNY
XLR8
HARDCORE GAMING
CERTIFIED

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Hitachi He10 10TB

Hitachi crams the population of China into a small family car. Kinda...

IN THIS BRAVE NEW solid-state era, it's easy to forget that magnetic drives still do the heavy lifting when it comes to mass storage. SSD prices may have tumbled, but multiple terabytes of solid-state storage remain super-expensive.

It's also easy to overlook the remarkable technical innovation that underpins the relentless increase in data density offered by the latest magnetic drives. To get an idea of the progress that's been achieved over recent decades, here's a nice analogy we shamelessly stole off the Internet. If cars had improved their cabin space since the early 1980s at the same rate that hard drives have increased data capacity, you'd be able to cram the entire population of China into a small family car. Crazy.

For more tangible proof of that progress, look no further than Hitachi's latest multi-platter masterwork, the Ultrastar He10. As implied by the "He" branding, one of the drive's defining features is the use of helium inside a hermetically sealed enclosure. This is actually Hitachi's third-generation helium drive, but it's worth revisiting what a funky feature this is.

Using helium in a hard drive bestows a number of advantages, the most obvious of which is gaseous density just one seventh that of air. That makes for less drag acting on hard drive platters. With less drag, the motor needs less power, and the fluid flow forces buffeting the platters and arms are reduced. Every little helps when you're trying to cram more data on to a magnetic platter than ever before. Indeed, the fact that it took Hitachi six years of engineering work to get the first helium drive to market speaks volumes about the technical challenges involved.

SHINGLE FILE

Still, if the helium bit isn't new, the He10's use of Shingled Magnetic Recording (SMR) technology is. The shizzle here, in layman's terms at least, involves the layering or overlapping of the recording tracks. Think of the tracks as arranged like an overlapping shingled roof, rather than tiles arranged edge-to-edge, thus allowing more tracks in the same surface area, and greater data density. How much greater? Well, say hello to the first 10TB hard drive.

As is often the case with new technologies, SMR has previously been problematical from a performance perspective. But with claimed sequential performance numbers in excess of 200MB/s from this 7,200rpm drive, that's something Hitachi seems to have solved. Our benchmark results paint a similar picture. In both ATTO Disk Benchmark and CrystalMark, the He10 cranks out around 250MB/s for sequential reads.

At three minutes, 26 seconds, it's also competitive with a SATA SSD in our real-world file compression test. The four minutes, 24 seconds it requires to complete the 30GB internal file copy metric is less impressive, however. But like all magnetic drives, the real downer compared to solid-state storage is 4K random access performance.

The He10 actually knocks out some reasonable 4K numbers for a magnetic drive, including 5.97MB/s writes in CrystalMark. That's very nice for a magnetic drive and is probably due, at least in part, to the new Media Cache feature on the He series. This reserves cylinders to use as instant write buffers, which reduces head movement, which in turn makes for shorter average seek times.

Of course, it's still a tiny fraction of the 100MB/s-plus even a half-decent SSD would achieve in the same benchmark. So don't go thinking the He10 has ripped up the rule book. SSDs remain by far the better bet for performance. But if you want a lot of storage in a single drive, and can handle the hefty price, this is surely as good as it currently gets. –**JEREMY LAIRD**

VERDICT 8

Hitachi He10 10TB

+ **BIG IS BEAUTIFUL** Massive storage capacity; excellent performance for a magnetic drive; full of fascinating technology.

− **MORBIDLY OBESE** Mediocre sequential performance compared to an SSD; terrible 4K performance; not exactly cheap.

$749, www.hgst.com

BENCHMARKS

	Hitachi He10 10TB	Hitachi HUA7220 2TB
AS SSD Sequential Read/Write (MB/s)	**231/190**	115/105
AS SSD 4K Random Read/Write (MB/s)	**0.63/2.8**	0.61/1.3
ATTO Sequential Read/Write (MB/s)	**251/253**	130/127
5GB Zip (Seconds)	206	**192**
30GB Copy (Seconds)	**264**	554

Best scores are in bold. Our test bench consists of an Intel Core i7-6700K, MSI Z170A Gaming M7, 16GB Crucial Ballistix Elite DDR4-2666, and a GeForce GTX 1080.

SPECIFICATIONS

Capacity	10TB
Interface	SATA III
Control Protocol	AHCI
Number of Platters	7
Rotational Speed	7,200rpm
Sequential Read	249MB/s
Sequential Write	225MB/s
Seek Time Read	8ms
Seek Time Write	8.6ms
Warranty	Five years

AOC U3277PWQU

It's 4K. It's beautiful. Is it future-proof?

IT'S ALL HAPPENING in the PC monitor market. The last year or two have seen a constant flow of innovation. High refresh rates, frame synching, tumbling response times—it just keeps coming. In the near future, HDR or high dynamic range displays are also expected to make the jump from the HDTV market to the PC.

It's into that acutely demanding context that AOC's U3277PWQU steps. At $1,212, it ain't cheap. Which demands the question of how it stacks up from a raw specification perspective, and what future-proofing it provides in this fast-changing market.

The headline numbers, thankfully, are impressive. The U3277PWQU combines a 32-inch diagonal with a full 4K pixel grid. That's 3840x2160 pixels. Enough desktop elbow room to be getting on with. In fact, for gaming, it's probably too many pixels for most GPUs. Right there, you're buying into the future. One day, 4K will be perfect for the latest graphics cards.

The U3277PWQU also sports Frame Rate Control (FRC) technology to enhance the color depth of the 8-bit panel, and boost the nominal 16.7 million colors to a full 1.07 billion. In that sense, it offers at least a slice of the upcoming wide-gamut and HDR action that's already revolutionizing HDTVs and console gaming. With both DisplayPort and HDMI 2.0 connectivity, it's also a flexible partner for a wide range of devices.

HELLO GORGEOUS!

But that's it. There's no 120Hz-plus refresh. No G-Sync or FreeSync. And no full HDR support. When you fire up the U3277PWQU, however, you might find you don't care. Because this display is gorgeous. Part of that is down to that combination of a generous-but-not-massive 32-inch diagonal and the 4K resolution. It makes for a nice, tight pixel pitch, but also allows you to use 100 percent scaling in Windows and maintain reasonable legibility.

It's also down to the fantastic VA LCD panel. IPS panels get all the love these days, and justifiably so in many regards. IPS is the most accurate LCD technology, and delivers the best viewing angles, too. But when it comes to visual pop, to color saturation, contrast, and black levels, VA cannot be beat. Which is why the U3277PWQU looks so stunning. You don't get deep inky blacks like this with IPS.

What's more, it's nicely calibrated out of the box, with both black and white scales showing lots of detail. Elsewhere, the news is mostly good. Pixel response, often a VA weakness, is reasonable, thanks to user-configurable overdrive technology, and the viewing angles are decent, if not quite up to IPS standards. The chassis is a nice bit of work, too. Until recently, AOC was seen as a budget brand. But it has seriously upped its game. This feels premium, from bezel tip to the foot of its multi-adjustable stand.

If you're looking for negatives, the anti-glare coating suffers from a little sparkle. Surprisingly, a whiff of banding is visible in color gradients, too. So much for those billion colors. But we're splitting hairs. Whether it's 4K video content or games, everything looks fantastic on this display.

All of which makes it a seriously appealing proposition, slightly tempered by the knowledge of what's just around the corner. Admittedly, that's pretty much always true for any technology—something better is bound to come along. At this price point and this moment in monitor history, however, that's particularly true. If you are buying today and the U3277PWQU fits your budget, it demands your attention. But know this: Things may look very different 12 months from now. **–JEREMY LAIRD**

VERDICT
8

AOC U3277PWQU

+ FUTURE-PROOF Nice balance of resolution and size; stunning colors and contrast; good build quality.

− FUTURAMA No frame-synching or high refresh; feels short on features in an increasingly innovative market.

$1,212, http://us.aoc.com

SPECIFICATIONS

Panel Size	32 inches
Native Resolution	3840x2160
Pixel Density	138
Panel Type	MVA
Max Refresh	60Hz
Response	4ms
Contrast	1000:1
Inputs	HDMI, DP, DVI, VGA
VESA Mount	100 x 100mm
Warranty	Three years

AOC has used VA panel tech to deliver awesome colors and contrast.

SteelSeries Siberia 840

Are we witnessing the best wireless headset?

IT'S A WIDELY HELD opinion among tech journalists that if you're after the best wireless headset money can buy, the SteelSeries H Wireless is your best bet. With outstanding audio quality, a retractable mic, an intuitively designed wireless dock, and a subtle sleek design, it solved all the problems that are associated with wireless headsets. Indeed, few manufacturers have even come close to matching the H Wireless's perfection. So, with the launch of the Siberia 840, an updated variant of the H Wireless, we had to get our hands on it to see exactly what had changed with this legendary design.

Where do we begin? Well, let's start with what's the same. The overall design aesthetic and comfort is identical to the H Wireless. The soft foam padding at the top of the band is still exceptionally comfortable (though we wish there was just a touch more at the crest of the crown). And you still get two interchangeable batteries included with the charging dock.

The dock is also almost identical to the one included with the H Wireless (now renamed the Siberia 800), supporting a variety of EQ adjustments, and with multiple options for audio out.

IN WITH THE NEW

What's changed, then? Three things primarily. Firstly, there's been a slight adjustment to the overall aesthetic design. Instead of plain plastic ear cups, you're now greeted with a faux brushed aluminum metallic finish. Bluetooth has also been included, to connect to other devices such as phones, laptops, and tablets. On top of that, the company has integrated support for its SteelSeries Engine desktop software, so you can control your profiles and EQ settings on your rig, as opposed to having them isolated on the battery dock. Apart from that, and it fitting into the new naming scheme, that's about it.

Differences aside, how does it fair as a headset? Honestly? Pretty damn good. The audio quality is exceptionally well rounded—SteelSeries has always prided itself on good quality balanced audio, and this is something you can definitely hear. There's nothing missing when it comes to an EQ; if anything, it could do with being a touch crisper on the upper end of the treble, for the sake of clarity, but that's something we'd usually expect to see in a headset with a higher frequency response than the likes of this—those frequency responses that are usually kept on the analog side of life.

The omnidirectional mic does a swell job of ensuring little background noise is heard, and your voice remains crisp and clear. Range is a good 20 feet, depending on walls and layout, and battery life is roughly 16–20 hours, depending on usage and volume. Not that it's an issue, as you'll always have a fully charged battery sitting in the dock, waiting to be swapped in.

What really impresses, however, is the Bluetooth. With it hooked up to a system and a cell phone, it's easy to take calls while gaming or when just sitting at the desktop, without having to worry about the quality of call, or being distracted from what you're doing. Indeed, when we received a call, the dock notified us that our phone was ringing, the headphones rang through, asked whether we wanted to answer it with a simple press of a button, and that was that.

But is it worth the money? $330 is a lot for any headset, and the fact that you can find wired audiophile solutions that provide far better sound quality, without the need to swap out a battery every now and then, is a big deal. What SteelSeries has achieved with the Siberia 840 is impressive, there's no doubting that, but at this price, it's food for thought whether you want the wireless freedom that the 840 provides, or the ease of use and audio quality of something a little more traditional. **–ZAK STOREY**

VERDICT

9

SteelSeries Siberia 840

+ SIBERIAN WINTER Comfortable; compact; intuitive battery solution; Bluetooth capability; dependable audio.

− RAIN IN LA Pricey; needs wider frequency.

$330, www.steelseries.com

SPECIFICATIONS

Driver Type	40mm neodymium dynamic
Frequency Response	20–20,000Hz
Microphone Type	Unidirectional
Connectivity	USB/optical/analog
Range	30 feet
Battery Life	20 hours (rated)
Weight	11oz

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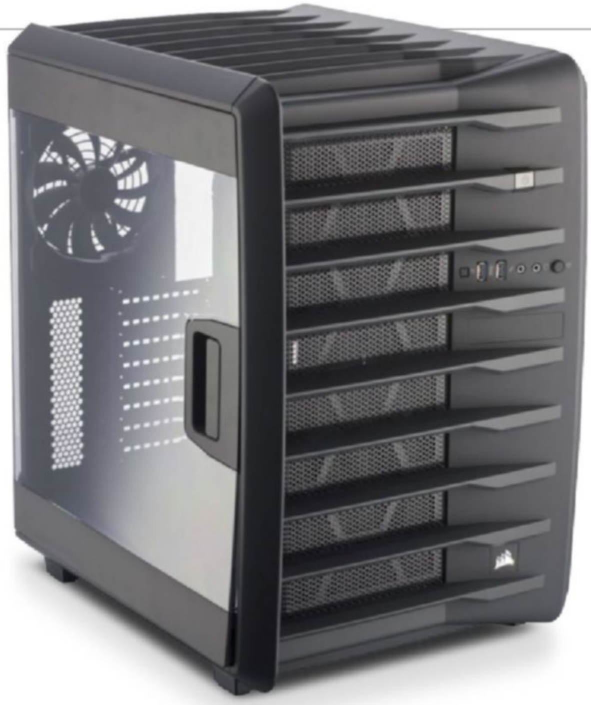
R

Rebranded or remastered?



Corsair Carbide Air 740

Reworking internal perfection

CUBOID CASES are a love/hate phenomenon. For some, the design is distinctive, reminiscent of a particular *Star Trek* species, a way of having a relatively small footprint for an otherwise cumbersome full tower. For others, they're big, bulky, and hold too much of a similarity with a leather pouffe, one ready to rest your weary feet on after a long day at work. Either way, it's hard to argue against the exceptional utility of the design. Separating off the PSU and hard drives from the main chassis helps reduce clutter, keep unsightly components out of view, and creates two separate air chambers, reducing those overall internal temperatures.

Corsair's Carbide Air 740, then, is a much needed upgrade on the somewhat aging Air 540. Far more rambunctious than its predecessor, the 740 has taken the best of the 540's stylization and incorporated it into a more modern-day solution. Gone are the dual 5.25-inch front drive bays, the floor-mounted 3.5-inch hard drive mounts, and the simple, refined design of its ancient ancestor, and in their place is a sleeker, tuned chassis, designed around the digital age. The overall cleaner internal layout allows for far superior cooling options, yet with still enough hard drive space to keep even the most enthusiastic RAID 5 supporter happy.

OF TWO MINDS

This chassis seems to suggest a meeting of minds—a mixture of Corsair's prestigiously professional Obsidian series, and the audacious glamor of the Graphite lineup. But does it pull it off? Hell, yes. The Carbide Air 740 looks simply stunning—more so in person than any photography could ever reveal. The meticulous matte finish keeps it looking sleek, while the dust-filtered front and top air intakes still house all the utility necessary to ensure a sound, cool interior.

Speaking of cooling, you're spoilt for choice. In the main compartment, you can fit a 360mm radiator in the front, a 280mm rad in the roof and in the floor, and a 140mm rad in the rear—or, of course, their corresponding fan sizes. The secondary chamber is a little less forgiving, with the potential to mount two 80mm fans in the rear, and, naturally, there's a sufficient filtered intake grate for your power supply to suck air through as well. But it's the main compartment that's most intriguing: Thanks to that compartmentalized design, and the shifting of the PSU into the secondary section, it actually gives you the option to run a more thermally attuned cooling orientation. For instance, if you have two 140mm fans in the floor drawing air in, three 120mm fans in the front as intakes, one 140mm in the rear, then two 140mm ones exhausting out of the roof, you produce a cleaner, more efficient airflow model, one that should help improve internal temperatures, and keep SLI or CrossFire systems supplied with a steady flow of cool N_2, O_2, and CO_2.

All in all, the Carbide Air 740 meets a huge list of needs and uses, and its flaws are few and far between. However, that's not to say that there aren't any. The biggest ones we found revolved around the 2.5-inch bays located in the rear compartment. Supporting up to four separate drives, you can easily remove the unused drive bays that you don't want via the toolless mechanism—at least, in theory. The fact that we had to hoist out the instruction manual for this task baffled us a little, but even doing that failed to reveal any insight as to what we needed to do to remove the additional cages, resulting in us snapping two of the retaining pins off one of the cages. Bad design? We think so, but it's certainly not enough to detract from the phenomenal positives of this chassis, and that's why it's well worthy of a solid score of nine. **–ZAK STOREY**

VERDICT 9

Corsair Carbide Air 740

+ **SILICON CARBIDE** Intuitive design; evolutionary change to internal layout; vast cooling support; smart and stylish.

− **CHARCOAL** 2.5-inch drive cages; slightly larger than most.

$150, www.corsair.com

SPECIFICATIONS

Form Factor	Mid-tower
Motherboard Support	ATX, microATX, Mini-ITX
Colors Available	Black
Window Available	Windowed only
3.5-Inch Support	3
2.5-Inch Support	4
Radiator Support	360mm front, 280mm roof/bottom, 140mm rear
Fan Support	3x 120mm front, 2x 140mm roof/bottom, 1x 140mm rear, 2x 80mm second compartment
Dimensions	16.8 x 13.4 x 20.1 inches
Graphics Card Clearance	13 inches
CPU Tower Clearance	6.7 inches
Weight	19lb

ADATA Ultimate SU800 512GB

The ultimate SATA drive? Not exactly...

WHAT WITH ALL THE lightning-fast PCI Express, M.2, and U.2 SSDs available to tease performance junkies with bandwidth measured in GB/s, it's hard to get excited by a conventional SSD that chats casually to your motherboard over a SATA connection.

Even the fastest SATA drives are limited to about 550MB/s. But here's the thing: If your motherboard only has SATA ports, and lacks support for features such as the SSD-friendly NVMe protocol, even with an add-in PCI Express card, achieving the full next-gen benefit of the latest and greatest SSDs makes for an expensive endeavor, one that includes at least a new mobo and probably a new CPU. Ouch.

Whisper this, but a decent SATA SSD actually gets the job done when it comes to day-to-day responsiveness from your PC. So, enter the new ADATA Ultimate SU800. It's a conventional 2.5-inch SATA drive that's hardly going to tear the PCI Express opposition a new one with numbers like 560MB/s reads and 520MB/s writes for this 512GB model. For the record, this family of SSDs tops out at 1TB; 128GB and 256GB models round out the full range for now.

Nor will the 90K maximum claimed IOPS performance turn many heads. That's not even remarkable by SATA standards. Still, that's not to say the SU800 is without innovation. Its key attraction is the use of high-density 3D triple-level-cell NAND memory, which helps to achieve a competitive price.

What's more, the total bytes written rating of 400TB is a solid figure for a 512GB drive. You also get a software key for Acronis True Image HD, for those who need help with a little drive-cloning action, and a reasonable three-year warranty. However, if affordability is the aim, something usually has to give. In this case, ADATA's choice of controller chipset is the most conspicuous candidate. It's a modestly specced item, with four memory channels, namely the Silicon Motion SM2258.

CACHE REGISTER

But what does it all mean for performance? As ever, the prep process prior to testing was enlightening. Fully filling the SU800 with data before diving into the benchmark suite revealed patchy sustained performance, as the drive cycled through periods of faster and slower behavior. The claimed 520MB/s write speed is achieved via pseudo-SLC caching, and it did feel like it was filling and refreshing a cache of some kind over and over again.

So, it wasn't a huge surprise to find variable write performance. A simple sequential test like ATTO gives numbers in line with that 520MB/s claim, but a more demanding metric, such as CrystalMark, reveals the SU800's limitations, courtesy of a 385MB/s result for sequential write. That said, the 4K numbers hold no horrors: 37MB/s and 46MB/s reads in CrystalMark and AS SSD respectively are decent for this class of drive, as are 137MB/s and 117MB/s for writes. And the SU800 puts on a good show in our real-world 5GB compression and 30GB internal file copy tests.

The upshot is that ADATA has a decent drive on its hands, but not one with any world-beating attributes. The SU800 will likely live or die according to price. At $130, it's competitive. Whether it's compelling depends on the daily fluctuations of SSD prices. But we'd prefer this solid SSD from a known brand such as ADATA to rolling the dice on an unknown quantity to save a few bucks. **–JEREMY LAIRD**

VERDICT

7

ADATA Ultimate SU800 512GB

+ BARGAIN BASEMENT Competitive price; plenty of capacity; reasonable specifications.

− FALSE ECONOMY SSD pricing changes quickly; mediocre performance; lack of stand-out features.

$130, www.adata.com

BENCHMARKS

	ADATA Ultimate SU800 512GB	Crucial MX300 1,050GB	OCZ Trion 100 960GB	Samsung 850 Pro 2TB
AS SSD Sequential Read/Write (MB/s)	510/483	479/480	**513**/436	**513/499**
AS SSD 4K Random Read/Write (MB/s)	**46**/117	28/113	31/92	41/**126**
ATTO Sequential Read/Write (MB/s)	563/**518**	418/495	**564**/517	404/427
5GB Zip (Seconds)	212	**178**	194	194
30GB Copy (Seconds)	**134**	158	263	160

Best scores are in bold. Our test bench consists of an Intel Core i7-6700K, MSI Z170A Gaming M7, 16GB Crucial Ballistix Elite DDR4-2666, and a GeForce GTX 1080.

SPECIFICATIONS

Capacity	512GB
Interface	SATA III
Control Protocol	AHCI
Controller	Silicon Motion SM2258
NAND Type	3D TLC
Sequential Read	560MB/s
Sequential Write	520MB/s
Read IOPS	90,000
Write IOPS	80,000
Warranty	Three years

SteelSeries Rival 500

An MMO mouse that actually makes sense

MICE DESIGNED around specific game genres and titles have always confused us here at *Maximum PC*. After all, everybody's different, and we all use our PCs in a wide variety of ways. Whether it's for gaming, working, browsing the web, listening to music, or all of the above, it's easy to see why the PC as a platform is so attractive to any and everyone. And that's the ethos that has, for as long as we remember, been adhered to when it comes to the overarching design of most peripherals. It's about versatility, not niche usage. So, to buy a mouse dedicated to one particular game genre seems a little odd to us.

Generally speaking, previous MMO and MOBA mice have always come across as a little uncomfortable, packed with way too many buttons, which are often too difficult to place or feel, and don't particularly help the user in any meaningful way, outside of what you can achieve with a standard keyboard and mouse anyway. So, it's safe to say that we approached this review with a fair wad of preconceived opinions already circulating around our heads. After all, the Rival 500 has one hell of a legacy to overcome—but, we're glad to report, it does so with relative ease.

Let's start with the basics. For $80, the Rival 500 comes with up to 15 programmable buttons, a PixArt PMW3360 optical sensor, registering up to 16,000 dpi, two-zone RGB lighting, to the sum of the usual 16.8 million colors, and an overall ergonomic design that caters to the right-handed palm, claw, or fingertip gripper, depending, of course, on the size of hand. Nothing out of the ordinary here, then.

So, what is it that makes the SteelSeries Rival 500 so much better than the other MMO mice offerings out there? Haptic feedback. Yep, that. On a mouse. Odd we know, but this is ridiculously useful, especially on a mouse with so many buttons, such as this. Allow us to explain: In short, most mice with 10 or more buttons take an eternity to master. Learning exactly where all your buttons are, and what they're bound to, can take an extraordinary amount of time, not to mention lining up your various in-game rotations, too. Very often, it results in those buttons being abandoned entirely, or demoted to the use of silly pointless social macros, to spam guild chat when they're not looking.

HAPTIC AWESOMENESS

With the Rival 500, however, you can assign each button to a specific style of haptic feedback. Jumping into the SteelSeries Engine, you can change how each individual button vibrates when it's pressed. Whether you want it to rumble once, twice, three times, for a long time, pulsate—you name it, it's there. What this provides is a reassuring notification of exactly what you've pressed, which then connects with those neurons in your brain to associate your finger position with the button, with the vibration, and with the ability that has activated on screen. It's exceptionally intuitive.

On top of that, you have the option to either disable or lock out the buttons entirely, either via a software option, or by a hard lock switch located below the mouse, which stops the buttons on the left side actuating, making this mouse almost the best of both worlds.

Is it perfect? Not quite. It still has a few niggles. For instance, not every button is within easy reach; it still feels a little clunky and less free-flowing than some of the more simplified mice designs; and it's nowhere near as ergonomic as something such as Mionix's Castor or Corsair's M65 Pro. But, damn it, it's still impressive. The improvements to ergonomic design, the plethora of programmable buttons, and the pinpoint accuracy of the PixArt optical sensor round the Rival 500 out to be a class leader, as far as MMO gaming mice go, and that's not something we say lightly.

–ZAK STOREY

VERDICT

8

SteelSeries Rival 500

⊞ **COMPETITIVE** Useful buttons; overcomes usual design tropes; comfortable; two mice in one; gorgeous design.

⊟ **ARGUMENTATIVE** Still bulky; can't locate all buttons; sore thumbs.

$80, www.steelseries.com

SPECIFICATIONS

Sensor	Optical
Sensitivity	100–16,000 dpi
Sensor Model	PixArt Technologies PMW3360
Polling Rate	1,000Hz
Programmable Buttons	15
LEDs	Two-zone, 16.8 million colors
Cable Length	6.5 feet
Weight	4.6oz

Corsair MM800 RGB Polaris Gaming Mouse Pad

RGB domination for your man dungeon

LET'S GET DOWN TO IT: this is Corsair venturing into madness. Into the RGB frenzy that is currently gripping manufacturers across the globe, as they strive to jam their latest and greatest peripherals with lights that are more colorful than one of Bob Ross's masterpieces. With the sheer volume of 16.8-million-color RGB products hitting the market, it was only a matter of time before someone decided to do the same with a mouse pad. Unfortunately for Corsair, it wasn't the first company to land such a bonkers product. Razer beat Corsair to it—by a good eight months, in fact. And despite some very mixed reviews, it does seem to be making enough financial sense for other manufacturers to take the concept, improve upon it, and provide their own solution for those looking to blind themselves in the unbridled fury of RGB desktop domination.

So, the MM800 Polaris. It's a mouse mat. A $60 mouse mat. In essence, it's a hard mat with a plastic polymer textured finish on top, and a non-slip rubber abrasive base. But it's still 60 of your hard-earned bucks. In short, you're paying for the R&D costs, to develop a way of showing off those flashy RGB LEDs. Speaking of which, the Corsair MM800 comes with a substantial thick outer strip of LEDs lining the exterior of the mat, alongside an illuminating logo on the bottom-right. And that's about it. For profiles, you get the whole color control shebang you'd expect, including a variety of wave, visor, and other styles included in Corsair's Utility Engine software.

Then, on top of that, you also have a single USB passthrough, integrated into the USB hub located at the top of the device. And therein lies our problem. The biggest issue we had with Razer's Firefly, when we were testing that, was the hub itself, and the same is true of Corsair's Polaris pad. As you're probably aware at this point, most mouse mats are completely flat. This leaves you free to use the entire surface. For most people, it's likely that you'll only use a small percentage of that surface area. Usually, that's the top-left, center, or right-hand side, and the rest is there purely for display purposes, for when you're not using the mouse. The thing is, by adding a raised hub at the top of the mat, you're introducing a point of contact that the mouse can, and often does, hit during the throes of gaming or using your desktop. There are two problems with this. The first is a physical issue: Hitting the hub means your mouse can't travel for the full extent of movement you intended it to make, so you may miss your target in games, or end up clicking the wrong thing. And the second is a mental issue. Basically, that consequent mistake and sudden halt in movement causes incredible frustration, which you certainly shouldn't have to endure with a $60 peripheral.

OI! CORSAIR! LISTEN UP!

This is something that both consumers and reviewers point out to manufacturers time and time again, yet our cries seem to be going unheard. We do understand that it's necessary to have the hub there, to power those LEDs, but there must be a way to either flatten it, or position it further down the cable, away from the mat itself, to alleviate these issues.

That aside (and ignoring the price), it's definitely an improvement over the Firefly. The LEDs are clearly visible from above, unlike the Firefly, meaning you can see them while gaming, and the color strips definitely look the part. On top of that, the textured surface tracks well. It would have been nice to see some way of swapping out the surface for something a little smoother or rougher, depending on your taste—which, let's face it, wouldn't be too much to ask from a $60 mouse mat—but otherwise it's a solid peripheral.

If you can look past the price, the additional USB cable cluttering up your desk, the somewhat pointless passthrough (for all your short-cabled mice…) leading to the frustrating bump, and the rough-and-ready textured surface, it's almost a good device. Now, just drop the price by $20, add in that swappable surface, and relocate the passthrough/power hub, Corsair, and we'll be sold. Alas, as it is, it just doesn't make the cut. **–ZAK STOREY**

VERDICT
5

Corsair MM800 RGB Polaris Gaming Mouse Pad

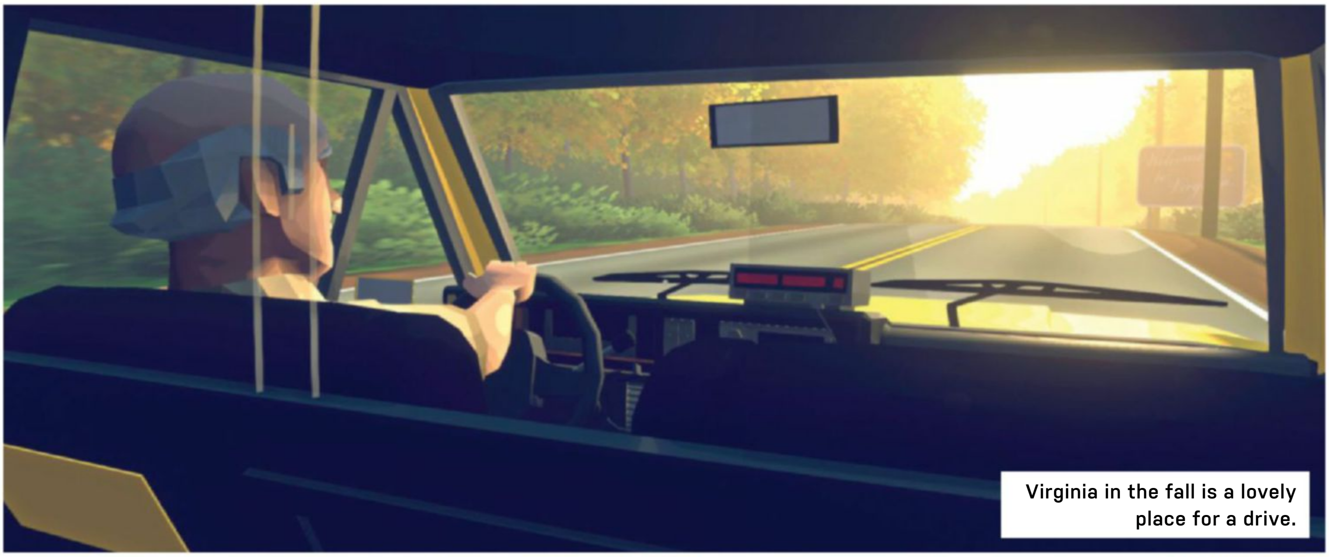
+ **POLARIZING** Better LED solution than competitors; good tracking.

− **REVERSE THE POLARITY** Hub bump; price; surface can be a bit rough; a touch noisy; another cable; pointless passthrough.

$60, www.corsair.com

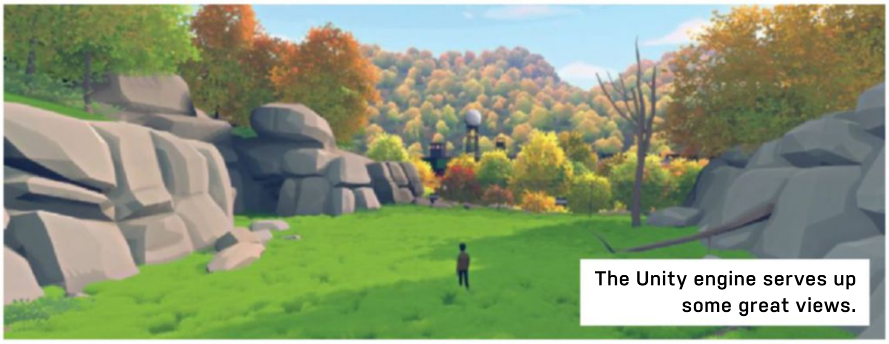
SPECIFICATIONS

Dimensions	13.8 x 10.2 x 0.2 inches (excluding USB bump)
Colors	16.8 million
Style/Material	Hard mat plastic
Warranty	Two years



Virginia in the fall is a lovely place for a drive.

Your partner, and the subject of an investigation.



The Unity engine serves up some great views.

Virginia

Police procedural takes a turn for the weird

YOU MIGHT THINK, on starting up *Virginia* and immediately graduating from the FBI academy, that you're playing a first-person investigation game. But you're not, and this becomes increasingly clear over the game's two-hour running time.

We've mentioned the length early on because it crams a lot into that short span. Every scene is crafted, with little filler apart from a few short corridor walks—and even these can serve to inform you of a character's status or mental state.

More interactive movie than walking simulator or traditional police game, *Virginia* is silent apart from a wonderful score and some sound effects. Meaning is conveyed through body language and faces, something the stylized, perhaps primitive, graphics are well chosen to express.

The game is as linear as an episode of the TV shows it takes inspiration from. There's no reason to explore, nothing to take you off the critical path. A dot in the center of the screen becomes a circle when it moves over something interactive, and a diamond when you're in range to use it. There's nothing else, and at some points you surrender control completely back to the game, particularly as it cuts you in and out of scenes and locations without warning.

There are some moments of hunt-the-pixel, as with the microfilm machine you must sweep your cursor over as you discover the series of moves needed to make it work, and maddening inconsistencies, such as a set of steps being unclimbable, while others in the same room, that are blocked, are your path forward. The one-button nature of the game takes the edge off, because at least you're not trying to work out whether you need to push, pull, or eat anything, but it feels simplistic that there isn't more to do, any secrets to find, or choices to make.

Much of your time is spent thinking about and trying to interpret what you've seen, which is made much harder by the way the missing-child narrative that introduces you to the game is faded into the background. It's your relationship with your partner, plus who and what you both are, that *Virginia* wants to explore, with both the first seconds of the game and an insulting encounter at a gas station being situations many players will not have experienced before.

For all its shortness and linearity, *Virginia* is compelling. Once the developers have established that there are no rules and there's no telling what might happen, the need to know where they're taking things becomes unbearable. Like the writers of *Lost* giggling about what they made you watch, there's a possibility that it's all just deliberately obtuse. But when you get to the affecting end of this strange slice of small-town America, there's a flash of something that makes you think maybe it was all planned out from the start. **–IAN EVENDEN**

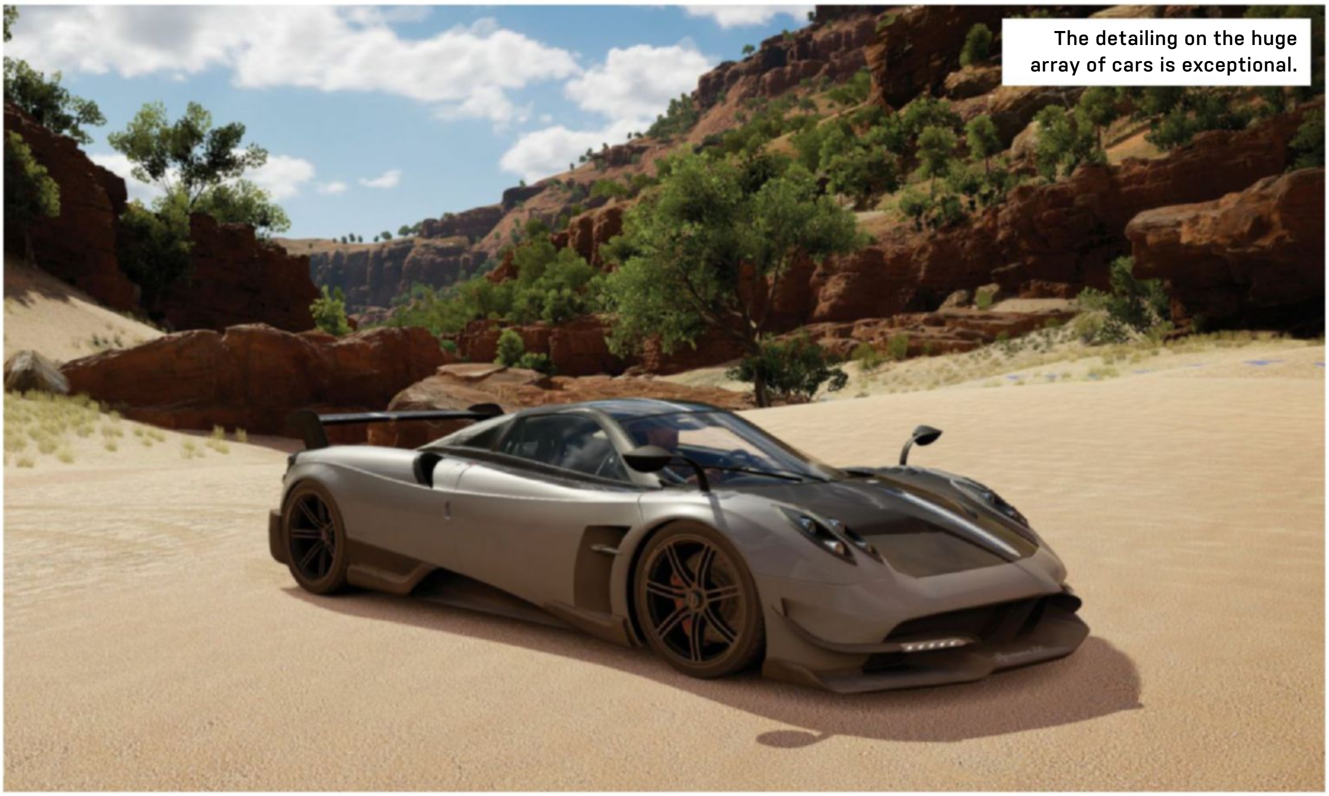
VERDICT 8 **Virginia**

COPS Expressive characters; urge to see what's next is strong.

ROBBERS Short; plot thins out; baffling.

RECOMMENDED SPECS AMD FX-6300 or Intel Core i5-2300; 2GB RAM; Radeon HD 7870 or GTX 660; 2GB VRAM.

$10, http://variablestate.com, ESRB: M


The detailing on the huge array of cars is exceptional.

Forza Horizon 3

Microsoft races into the Universal Windows Platform

SPEED: THE SENSATION, the rush, the feeling as your body is held captive by the forces acting upon it—it's addictive; it's pure adrenaline. The invention of the car stimulated this human desire, making it accessible to all, and video games have always sought to emulate that experience, to put you in the driving seat, to immerse you in the world, but within a far safer environment. One without risk.

Forza Horizon 3 is the third in Microsoft's *Horizon* series, designed as an open-world, arcade-like driving game experience. However, it's best to understand ahead of time that this is as much a simulator as James Corden is a basketball player. It has sim elements littered here and there, yet it falls short of the likes of *Project Cars*, or even *Gran Turismo.* Weight distribution, dynamic tuning of vehicles—there's a plethora of things there, but everything is over-emphasized, or run on rails. It's rare to flip a car, and it's entirely possible to drift around the whole map in a single go, if you so desire.

The absolutely phenomenal number of cars all have their own personality, their own feel—you can tell the difference between the Corvettes and the F100s, in speed and in handling—but there's little really to differentiate them from similar counterparts. The engines also sound crass and bland. The spitting snarl of the Jaguar F Type's eight cylinders as it shifts gears is absent, replaced by some dull generic tone that can be found emanating from 50 other cars in the game. The V12s are monotonous, and it's only the 4x4s and modern pickups that house more realistic sound valves—even the glorious Holdens lack the bite they're so notorious for.

Is that to say it's a bad game? Not at all—if you're after a quick blast around an open world, *Forza Horizon 3* is perfect. Jump in, choose your car, and drive around, no holds barred. Want to head to the desert? Sure. Rainforest? Just set that in your sat-nav, and drive. Fancy some beach drag chaos? We can do that, too. The open sensation is huge and imaginative—each time you turn a corner, and approach from a different angle, it's like an entirely new set of roads laid out before you. The game modes and challenges are equally thrilling, if not a little puerile. The game rewards you for near-misses and head-on collisions, drifting around corners, smashing through property, and getting caught by speed cameras. The races themselves leave a lot to be desired, the progression is almost immediate, and there's little build-up or sensation of progress—most of the game's high-end cars are within spitting difference, and with little difference between them.

If you're after a game where you can jump in and have a mess around online, with your friends, on different platforms, wherever you are, *Forza Horizon 3* is for you. But as driving simulators go, it lacks the immersion and depth that we've come to expect from the *Forza* series. Yet, with the likes of *Project Cars* weighing heavy on the minds of most PC gamers, it's a tall order to fill—one we're hoping subsequent patches and DLCs will fix. **–ZAK STOREY**

VERDICT
7

Forza Horizon 3

LIMITLESS Huge plethora of cars; dynamic changing environment; glorious graphics; open world; play anywhere.

STUNTED Basic physics; lack of immersion; progression feels absent; plot seems empty; sensation of speed.

RECOMMENDED SPECS Intel Core i7-3820 @ 3.6GHz, Nvidia GTX 970/1060 or AMD R9 290X/RX 480 (4GB of VRAM), 12GB RAM.

$60, www.xbox.com, ESRB: E

LAB NOTES

ZAK STOREY, REVIEWS EDITOR

Apple Can Do One

The company with delusions of audio grandeur

IT'S TIME I WADED INTO the debate. What am I talking about? The removal of the headphone jack from the latest iPhone. I'm passionate about good quality audio. I could probably write a PhD thesis on the subject.

So, let's get things straight regarding this latest "innovation." It's a polarizing topic—some people are behind it, others less so. Myself? I fall into the latter camp. The idea is total nonsense. Apple has apparently always been ahead of the curve when it comes to ditching archaic or aging connection standards. It threw away the floppy drive, Ethernet, and the USB port to pursue thinner and more stylish devices, while championing newer standards (usually its own). The thing is, unlike changing from VGA to HDMI, or USB to Lightning, the concept of shifting from the 3.5mm analog jack to Bluetooth for better audio quality is nothing short of ridiculous. Bluetooth, although greatly improved since conception, is simply not capable of providing pure lossless audio compression, or better quality audio, with the standard being limited to 48kHz, resulting in a maximum bitrate of 345kb/s. Spotify audio quality, to be frank.

On top of that, you have to consider how audio is reproduced via the 3.5mm jack. It's a modulating signal that vibrates a magnet with a diaphragm on the other side, creating sound waves. No matter what you change or use, you'll always end up with an alternating current vibrating a diaphragm, whether it's via Bluetooth, USB, or 3.5mm analog. Take a look at any premium pair of headphones today, and you'll notice one thing: None of them are Bluetooth. Hell, none of them are even USB. And that's the point. It's a move that's as necessary as Intel adding an extra pin with each generation of processor—and, by God, for the sake of good, straightforward audio, I hope this doesn't become a trend.

Courageous? I'm not so convinced.

JARRED WALTON

Senior Editor

You might think that if anyone can do PC gaming properly, Microsoft—the company behind the Xbox consoles, not to mention Windows—would be a prime candidate. But Games for Windows left a sour taste in gamers' mouths everywhere. Microsoft is back for another stab at PC gaming as a platform, this time in the form of the Universal Windows Platform (UWP). To say it's a mixed blessing is putting it kindly; UWP is about control—specifically, ensuring users do not have any.

I've managed to avoid UWP games so far, but *Gears of War 4* is a UWP exclusive. The good news is we actually have *Gears of War 4* on PC, along with *Forza Horizon 3*, and several other Microsoft games. Microsoft also plans to have all future first-party Xbox One titles launching on both Xbox and PC. And that's a pretty sweet bone tossed our way, assuming it keeps it up.

Unfortunately, UWP also has problems. It's Windows 10 only, it uses the execrable Xbox app for Windows—with a UI straight out of the '90s—and things are locked down tight. *Gears of War 4* is an insane 73GB download, but suppose you have more than one PC—Steam, GoG, UPlay, and Origin all allow you to copy the appropriate files to another PC, and skip the second download. UWP says no to such efforts. Sigh.

Can't we just call it Games for Windows 10, and get it over with?

Editors' Picks:
Digital Discoveries

Tuan Nguyen, editor-in-chief, and Alan Dexter, executive editor, reveal their latest tech loves

MRSPEAKERS ETHER FLOW

What if you're gaming or listening to audio, but want to be discreet? Perhaps you're enjoying something you don't want someone else to know about. Headphones are my go-to ticket for such adventurous times. Not gaming headsets. Headphones are, frankly, head and shoulders above gaming headsets. And, after testing an ocean of them, the MrSpeakers Ether Flows are my favorites.

Based on planar-magnetic drivers, the Ether Flows exert exceptional control over sound waves. Designed with extended use time in mind, they are lightweight and extremely comfortable. The plush ear pads are also angled, allowing the headphones to completely envelop your lobes, although if wearing glasses, you must let the frames rest on top of the ear pads to prevent a leak.

I've been using the Ether Flows daily for several weeks, and they blow everything I've tested out of the water. All types of music, movies, and games sound great. Bass is tight and masterfully controlled, mids carry presence, and highs are crystalline. The catch? Be prepared to spend $1,800 for their end-game caliber sound.

$1,800, www.mrspeakers.com

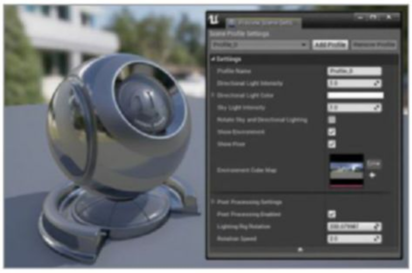
UNREAL ENGINE

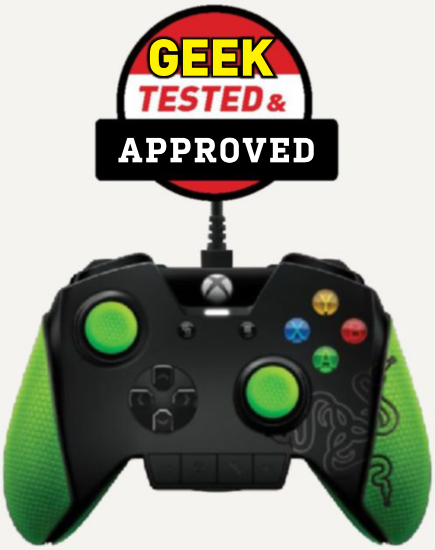
I used to dabble in programming. In fact, for a while, it was my job. Then I got into tech journalism, and that had a much stronger pull than bullying ones and noughts into doing their thing. The thing is, the programming itch is still there, waiting to be scratched. Not to make a living, but in a way that those who turn to crosswords, quizzes, or learning a modern language will understand. It's a mental exercise that keeps the old gray matter ticking over.

I scratch this itch now and again with the help of the Raspberry Pi and Python, but I also have a tendency to install the latest Unreal Engine from time to time. Because, while I appreciate a clever piece of code as much as the next hack, I'm also a sucker for lush graphics and immersive environments. You know, the sort of thing that most triple-A games produce as an aside.

I'm not interested in taking the world by storm with a full-blown game, but I do like to see what I can produce with the latest tools. Whether it's a demo, music visualizer, or something funkier. The good news is that the likes of Unreal Engine are now free to play around with—you only need to pay royalties once you release your game or app.

Free, www.unrealengine.com





Razer Wildcat

I'M GENERALLY OF THE OPINION that the best way to play PC games is to use a keyboard and mouse. I recognize there's a need for steering wheels and flight sticks, but in my experience, these tend to spend more time gathering dust than being used. And controllers are best left for those dumb consoles. Having said that, games reviewers are often found citing that a particular game is "best played with a controller." For me, this generally meant grabbing a barely-used Xbox 360 controller, until I laid hands on the Razer Wildcat. And I have to say it produces a far more positive experience than I expected—it's amazing in fact.

For a start, it's incredibly comfortable to use—something that's improved by those unsightly, and ill-fitting, green pads, which help the more-sweaty-of-palm to stay in control. The rubber-coated analog sticks don't ping out from under your thumbs either. Then there's the wealth of buttons hidden underneath. There's a total of eight extra triggers alongside the four traditional buttons on the top—more than enough for most games. You'll have to adopt a slightly different grip to access them all, but this feat of dexterity is well worth it.

Having battled with dodgy controller drivers over the years, it's reassuring that the Wildcat just works straight out of the box, too. You can install Synapse if you want, but I didn't have a problem using it without doing so. The only potential fly in the ointment is the cost, but if you're seriously into your gaming, this is a treat you could probably convince yourself you need. Color us impressed. **–AD**

$131, www.razerzone.com

LETTERS

WE TACKLE TOUGH READER QUESTIONS ON...

> Illegible Text
> Sourcing Prices
> Temperature Conversion

Contrasting Views

I'm a long-time subscriber, and I really enjoy *Maximum PC*, but lately you've been doing a lot of printing on black backgrounds on the hard-copy edition. This is fine, except for the fact that you're printing hyperlinks in dark blue ink on that black background. That makes them almost impossible to read, especially when they're bit.ly links. You can see what I mean in the "Advanced Windows 10 Tips & Tricks" article appearing in September's publication. Please choose another color that shows greater contrast against a black background.

–Phil Hoffman

EXECUTIVE EDITOR ALAN DEXTER RESPONDS: While I like to think that we test our readers at times, this isn't quite what I had in mind. Although the links were just about readable on our proofs, they turned out to be pretty much impossible to discern in plenty of copies of the magazine (due in part to subtle registration problems on some prints). Apologies to everyone who had problems with this. And just so you know, this is what those URLs actually linked to:

PAGE 29
Malwarebytes
www.malwarebytes.com
Unchecky
www.unchecky.com
PAGE 30
Ultimate Windows Tweaker
http://bit.ly/uwt-win10
Classic Shell
www.classicshell.net
Start10
www.stardock.com
PAGE 32
O&O ShutUp10
www.oo-software.com
PAGE 33
Macrium Reflect Free
www.macrium.com/reflectfree.aspx
Guide to using Macrium
www.techradar.com/1319885
EasyBCD
https://neosmart.net/EasyBCD

Creating My Own Cloud

While trying to install OwnCloud on my Raspberry Pi, I got the following error message: "tar: owncloud-9.0.2.tar.bz2: cannot open: No such file or directory."

Help—anyone else having this problem? I am a newbie with Linux, so it could just be me.

–Pete Swentzel

EXECUTIVE EDITOR ALAN DEXTER RESPONDS: While we usually suggest that you install packages using apt-get, for this tutorial, we actually just told you to download the main OwnCloud application straight from the website, under the "You'll need this" heading at the start of the project. It's worth noting, while we're here, that OwnCloud has updated to version 9.1.1, so once you have downloaded the file, you will need to unpack the tarball with:

```
$ sudo tar -C /var/www/html
-xf owncloud-9.1.1.tar.bx2
```

Once you've done that, you should be able to continue with the rest of the tutorial without a problem.

Three-Way Challenge

You said in a past issue you look forward to building challenges—well, one of my favorite articles of yours was back in 2013, when you had a three-way budget gamer's build, where three editors put together different systems, picking whatever parts they wanted for a total of $750 (including the cost of the OS). It was really fun to see the differences in benchmarks between a weak CPU, but strong graphics card, vice versa, and middle of the road. I would suggest you repeat this event, if not make it an annual one. In the same way that Dream Machine exemplifies the best of the best, this would be a great "bum fights" contrast. Also, I would suggest not "cheating" with a Linux install, the way you do in your budget gamer build recommendation. I'm all for people using Linux, but recommending it to avid gamers on a budget I think is a little disingenuous, due to game compatibility.

–Ross Scott

EXECUTIVE EDITOR ALAN DEXTER RESPONDS: This is a great idea, and something we've been thinking of doing in one form or another for a while, but weren't sure if it would be of interest. Consider your support for it enough to push us over the edge. Watch this space.

Optimize This

When was the last time you did a general game optimization guide in the magazine? I am pretty forgetful, so excuse me if I somehow hallucinated an entire section of a magazine.

–Alex Sarosi

EXECUTIVE EDITOR ALAN DEXTER RESPONDS: No hallucination—we covered

↘ submit your questions to: comments@maximumpc.com general game optimization back in the May 2016 issue (Volume 21, No. 5). We also cover optimizations for the latest games over at www.pcgamer.com/hardware, if you're looking for a specific title.

Built to Last

In the October issue, Peter H asked about a system built to last, and your response was the old computer you let your wife and kids use. I believe the question was more on a system that will actually last, because any new system will be relevant for long-term use for Internet purposes.

I have recently also built a computer to last. I started with a Platinum-rated power supply, with an MTTF of more than 100,000 hours. I also try for a fanless setup wherever possible, eliminating moving parts. If not, use high-quality fans, such as Noctua. Also important is a high-quality motherboard with Japanese capacitors. You can also get a Corporate Stable Model (CSM), as well.

I have an Asus mobo running a Core i7-6700K (never overclocked), Samsung Pro NVMe solid state drive, and 16GB memory, EVGA Platinum power supply (10-year warranty), and no video card (gasp). This system boots in seconds, is very responsive for everything I do, and completely silent. This system will last, and be relevant, for years. Add a video card, and it's a gaming rig. **–Doug Heerema**

EXECUTIVE EDITOR ALAN DEXTER RESPONDS: This is an impressive build that will indeed last for many, many years. And, as you say, pop a graphics card in the slot, and you've got an instant gaming powerhouse. Our recommendation to Peter H was a little more concerned with keeping the initial outlay low, which is why pointing him at an older machine made sense to us.

Silent Lust

I read the review of the Be Quiet! Dark Base Pro 900 and was nearly drooling! Problem is, I can't find it anywhere, and it should have been available since around June 2016. It seems neither Amazon, nor Newegg, nor BestBuy carry it. I can't even find a way to order it directly from the manufacturer (not that I want to, due to cost—usually available for lower cost online). Where is it available, and where did you find the price? I could only find a price range at www.bequiet.com.

Also, I used to be able to get to *Maximum PC* online. Now www.maximumpc.com is replaced by *PC Gamer.* I don't want to go to there when I'm trying to go to *Maximum PC.* I know the two have combined, but where is all the good hardware info that is in *Maximum PC?* Gaming may be the big thing, but keep the websites separate! **–Tom Beall**

REVIEWS EDITOR ZAK STOREY RESPONDS: If a piece of hardware is already available when we review it, we take the pricing from the very sites you mention. However, if a piece of kit is so new that it hasn't hit the shelves yet, we go straight to the manufacturer to find out what the MSRP is. Which is exactly what happened with the Dark Base Pro 900. The good news is that this kick-ass case is now readily available from plenty of sites. You can get the Be Quiet! Dark Base Pro 900 from Newegg—it's currently available for $229, which is $20 less than the manufacturer's price. So a win-win all around, then.

EXECUTIVE EDITOR ALAN DEXTER RESPONDS: When it comes to the website merger, it's worth noting that it's relatively early days still, and we're trying to get the balance of content just right. The positive side of this is that we have more people available to cover events. More writers to write reviews, features, and articles. And due to the clout that *PC Gamer* has in certain areas of the industry, we have better access to some manufacturers, too. So stay with us, and let us know your thoughts.

Silly Science

In the November 2016 issue, under "Tech Tragedies and Triumphs," the note on atomic-scale HDD references a temperature of -321 C. Since -273.15 C is absolute zero, getting another -48 degrees is a really hard accomplishment. Hope this helps the technical team trying to reach that goal. **–Stephen Einson**

EXECUTIVE EDITOR ALAN DEXTER RESPONDS: That's the problem with having two different temperature scales in use around the world: we can drop below absolute zero, the universe ceases to exist, and someone like me doesn't notice (and plenty of my old tutors would hang their heads in shame, too). I'm going to sit in a corner as penance. It's cold over there. Very cold. (The story should have read -321 F, -196 C, or 77 K, by the way.)

Linux Love

I wanted to thank you for your continued Linux coverage. I was actually going to cancel my subscription, but because of the monthly Linux coverage, I'm going to continue subscribing.

–Dr Nikolas Hedberg

EXECUTIVE EDITOR ALAN DEXTER RESPONDS: Good to hear you're loving Linux. We've got a couple of in-depth articles lined up for the future, and we've got plenty of tutorials to keep you happy, as well. While we love the simplicity of Windows, the times we pop into Linux are on the increase. Glad you're going to be along for the ride.

[NOW ONLINE]

THIS IS WHAT OCULUS'S NEW WIRELESS PROTOTYPE RIFT IS LIKE

In his keynote at Oculus Connect, Mark Zuckerberg told the audience that he had no new hardware to show—but he also said that Oculus was putting its strength toward making a truly mobile Rift experience, and it turned out there was some very early hardware at the show, aimed at that very goal. Tuan Nguyen, editor-in-chief, got to try on the "Santa Cruz" headset. You can read the full story online at http://bit.ly/2dIziZT.

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4K READY
OCULUS RIFT COMPATIBLE
DRM FREE

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- ✓ Complete round-the-clock news
- ✓ The best PC reviews and features
- ✓ In-depth hardware coverage

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THE BUILDS

BUDGET

INGREDIENTS

PART			PRICE
Case	Thermaltake Core V1		$49
PSU	EVGA SuperNOVA 550 GS		$82
Mobo	ASRock H170M-ITX		$85
CPU	Intel Core i5-6500		$205
GPU	Zotac GeForce GTX 1060 Mini 3GB		$200
RAM	8GB (2x 4GB) HyperX Fury DDR4-2400	**NEW**	$39
SSD	256GB SanDisk Z400s 2.5-inch SSD	**NEW**	$70
HDD	1TB Hitachi 7,200rpm 3.5-inch SATA	**NEW**	$43
OS	Ubuntu Desktop Linux 16.04 LTS 64-bit		$16

Approximate Price: $789

NOW THAT THIS GENERATION OF GPUS has been released in its entirety, prices are settling down on the graphics card front, which means there are no big changes for the core components this month. We're still very happy with the 3GB spin of the GTX 1060, so that stays, alongside the Core i5-6500, to form the core of this machine. There have been pricing shifts on the memory and storage fronts, though. Our previous memory of choice, the G.Skill Aegis DDR4-2133, saw a notable price hike, so we grabbed a pair of 4GB HyperX Fury DDR4-2400 sticks instead, which cost $2 more than the G.Skill kit, but are faster, so a reasonable upgrade. Our previous boot SSD, the SanDisk X400, also saw a price increase, so we've used a 256GB SanDisk Z400s, which is significantly cheaper. This, combined with the decision to go for a more generic 1TB hard drive, means that we've managed to keep the overall price under $800.

MIDRANGE

INGREDIENTS

PART			PRICE
Case	NZXT Manta		$120
PSU	EVGA SuperNOVA G2 650W 80 Plus Gold		$100
Mobo	Gigabyte GA-Z170N-Gaming 5		$135
CPU	Intel Core i5-6600K		$240
Cooler	Corsair H100i v2		$105
GPU	Zotac GeForce GTX 1070	**NEW**	$380
RAM	16GB (2x 8GB) G.Skill Ripjaws V Series DDR4-2400		$83
SSD	250GB Samsung 850 EVO M.2		$100
HDD	Western Digital Black Series 1TB 7,200rpm		$72
OS	Windows 10 Home 64-bit OEM		$100

Approximate Price: $1,435

THERE AREN'T MANY CHANGES to our midrange system this month, despite a few shifts in pricing on most of the components. Overall, we've managed to shave $46 off the price—although, as ever, if you want to be a bit more aggressive with your budget, there are deals to be had from bundles and daily deals. On the price front, we saw a $10 saving on the case, but that was lost to the PSU, which was $10 more expensive this month. The motherboard saw the greatest saving, rolling in $26 cheaper than last time, which helps our bottom line. The only real change this issue is swapping out last month's Gigabyte GeForce GTX 1070 Windforce for the Zotac card. Both are triple fan designs, which mean that they run quiet and cool, while packing a serious punch at sub-4K resolutions. This Zotac card is $20 cheaper than the Gigabyte at the moment, which gave it the edge, plus you can pick up a free copy of *Gears of War 4* if stock is still available.

TURBO

IT'S ALWAYS TEMPTING to upgrade the Turbo machine to the latest "Extreme Edition" Broadwell-E CPUs, just so we're recommending the newest hardware. However, as there's scant reason to do so, we simply suggest that any high-end build uses the last-gen Haswell-E Core i7-5820K. It's getting on a bit, but it still offers great performance at a great price (relatively speaking). The newer Core i7-6800K rolls in at $440—$50 more than its predecessor, yet offering only marginal real-world improvements. We'll keep monitoring it, though, and will make the shift once supply of the older tech puts pressure on pricing.

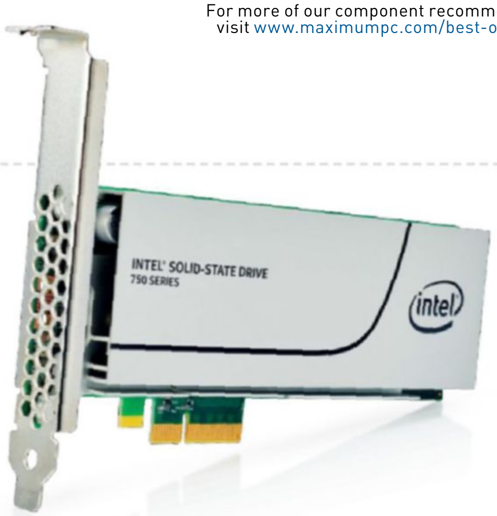
As with the other machines, we've seen some movement on pricing, though it has mostly seen components getting more affordable. The exceptions were a slightly more expensive PSU, and a $10 premium on the memory. These increases were absorbed elsewhere without having to change any components, with one exception: While graphics card pricing has remained steady at the more affordable end of the spectrum, when it comes to the GeForce GTX 1080, there's a bit more room for maneuver. We managed to snag an EVGA GeForce GTX 1080 SC Gaming for a bargainous $650. We were almost tempted to double up and go down the SLI route, but as the Dream Machine 2016 proves, SLI support is still not guaranteed, and the idea of dropping $650 on a second card that will do nothing for our frame rates left us cold.

For more of our component recommendations, visit www.maximumpc.com/best-of-the-best

INGREDIENTS

PART		PRICE
Case	Phanteks Enthoo Evolv ATX	$160
PSU	EVGA SuperNOVA G2 750W	$115
Mobo	Asus X99A II	$200
CPU	Intel Core i7-5820K	$390
Cooler	Corsair H100i v2	$105
GPU	EVGA GeForce GTX 1080 SC Gaming **NEW**	$650
RAM	32GB (4x 8GB) G.Skill Ripjaws V Series DDR4-2666	$150
SSD	1.2TB Intel 750 Series PCIe SSD	$700
HDD	4TB WD Black 7,200rpm 3.5-inch SATA	$214
OS	Windows 10 Home 64-bit OEM	$100

Approximate Price: $2,784



UPGRADE OF THE MONTH

INTEL 750 SERIES 1.2TB PCI-EXPRESS SSD

We've seen a number of impressive deals on this family of PCIe SSDs this month, with the high-end 1.2TB coming in at a cool $400 under the recommended price. We used the U.2 version of this SSD in our Dream Machine 2016, and, like this add-in card, the raw performance is simply breathtaking. While any SSD will give your system a boost over a spinning drive, the 750 goes one step further, with maximum reads and writes of 2.5GB/s and 1.2GB/s respectively. Be sure to shop around for the best deals for your price bracket, though.

$700 (1.2TB), www.intel.com

Maximum PC (ISSN 1522-4279) is published 13 times a year, monthly plus Holiday issue following December issue, by Future US, Inc., One Lombard Street, Suite 200, San Francisco, CA 94111. Phone: (650) 872-1642. Fax: (650) 872-2207. Website: www.futureus.com. Periodicals postage paid in San Bruno, CA, and at additional mailing offices. Newsstand distribution is handled by Curtis Circulation Company. Basic subscription rates: one year (13 issues) US: $24; Canada: US$40; Foreign: US$40. Canadian and foreign orders must be prepaid. Canadian price includes postage and GST (GST #R128220688). PMA #40612608. Subscriptions do not include newsstand specials. POSTMASTER: Send changes of address to *Maximum PC*, PO Box 5852, Harlan, IA 51593-1352. Standard Mail enclosure in the following editions: None. Ride-Along enclosure in the following editions: None. Returns: IMEX Global Solutions, PO Box 25542, London, ON N6C 6B2, Canada. Future US, Inc. also publishes *@Gamer*, *Mac|Life*, *The Official Xbox Magazine*, and *PC Gamer*. Entire contents copyright 2016, Future US, Inc. All rights reserved. Reproduction in whole or in part is prohibited. Future US, Inc. is not affiliated with the companies or products covered in *Maximum PC*. Reproduction on the Internet of the articles and pictures in this magazine is illegal without the prior written consent of *Maximum PC*. Products named in the pages of *Maximum PC* are trademarks of their respective companies. PRODUCED IN THE UNITED STATES OF AMERICA.

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